Kake – Petersburg Transmission Intertie Study

FINAL REPORT

Prepared for

The Southeast Conference
Juneau, Alaska

by

DHITTLE & ASSOCIATES, INC.
Engineers and Consultants

July 2005

Funded through a grant from the Denali Commission.

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In association with:

Commonwealth Associates, Inc.
CH2M Hill, Inc.

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Introduction

The Southeast Conference is continuing to evaluate the feasibility of constructing a transmission line between Kake and Petersburg (the "Kake – Petersburg Intertie" or "KPTL") to deliver surplus hydroelectric power to Kake and eliminate the total reliance upon diesel generation that currently exists. In September 2004, the Southeast Conference retained D. Hittle & Associates, Inc. (DHA) to conduct a study of the KPTL (the "KPTL Study") as a follow-on study to the Southeast Alaska Intertie Study prepared for the Southeast Conference in 2003 (the "2003 Intertie Study"). The 2003 Intertie Study provided an overview of a complete electrical transmission system in Southeast Alaska with emphasis on two initial transmission interconnection segments between: (1) Kake and Petersburg and, (2) Juneau, the Kennecott Mining Company – Greens Creek Mine (KMC-GC) on Admiralty Island and Hoonah.

The 2003 Intertie Study identified two primary route alternatives for the KPTL, a northern route generally located on the north end of Kupreanof Island and a southern route that crosses the Wrangell Narrows near the Tonka log transfer facility and proceeds west across Duncan Canal. Both routes were expected to follow existing logging roads for the majority of their lengths, however, the southern route was preferred because of a generally more protected location, a shorter length, less scenic visual impact and a lower estimated cost of construction. The northern route of the KPTL was considered to be along a more likely route for a year round maintained road between Kake and Petersburg.

Much has happened with regard to transmission development in Southeast Alaska since completion of the 2003 Intertie Study. The Southeast Conference has continued to pursue funding for the two initial transmission segments, Alaska Electric Light & Power (AEL&P) has undertaken additional studies, permitting and design of the Juneau – KMCGC segment of the Juneau – Hoonah transmission line, AEL&P has continued to pursue development of the Lake Dorothy hydroelectric project, the Kwaan Electric Transmission Intertie Cooperative (KWETICO) has been formed to own and operate the new transmission Interties and the Four Dam Pool Power Agency (FDPPA) has begun construction of the Swan – Tyee transmission line.

With regard to the KPTL, a number of issues have been raised that will affect the potential routing and configuration of this line. Although most of these issues were known to some degree at the time of the 2003 Intertie Study, the potential impacts of recent developments have been more thoroughly assessed in this study in preparation of permitting and final design activities. Among these issues are:

- Continued discussion and evaluation of a potential year-around road between Kake and Petersburg;
- Potential mining developments on Woewodski Island and elsewhere in the general vicinity of Kake and Petersburg;

- Recent experience of the FDPPA with regard to design modifications and construction of the Swan – Tyee transmission line as well as uncertainty in the timing of its completion;
- Recent experience of AEL&P with regard to permitting and initiation of construction of the Juneau – KMCGC transmission line;
- Changes in the financing covenants of the FDPPA that might affect the price of power sales from the Lake Tyee project to Inside Passage Electric Cooperative (IPEC), the electric utility that serves Kake;
- Increases in the worldwide price of metals and the effect this may have on materials needed for new transmission lines;
- Significant increases in oil prices that affect the cost of power production in Kake;
- Reductions in power requirements in Kake due to the closure (potentially temporary) of a seafood processing facility; and
- Specific requirements in the KWETICO bylaws that affect the feasibility evaluation of potential new transmission lines.

The KPTL Study has considered all of these issues in providing a more detailed feasibility evaluation of the route alternatives and configuration of the KPTL than was provided in the 2003 Intertie Study. Further, the evaluation of another possible route alternative for the KPTL given the potential opportunity for future development of a major mining operation on Woewodski Island has been provided. The possibility of integrating a large mining load into the regional power grid could have a major positive impact on future development of power resources in Southeast Alaska. Evaluation of the estimated costs and benefits of a potential transmission interconnection with Woewodski Island is a critical component of the KPTL Study. The potential impact of a road between Kake and Petersburg has been factored in to the KPTL Study.

One of the primary purposes of the KPTL Study is to provide the needed information for the Southeast Conference to identify the recommended route and configuration of the KPTL. On-site field reconnaissance and engineering assessments were provided to serve as the basis for establishing preliminary configuration specifications and updated, detailed cost estimates. Since certain regional developments, such as a mining facility on Woewodski Island, are potentially ten years off, it is necessary to forecast costs and benefits into the future to determine what alternative configurations of the KPTL can provide the greatest potential benefits to the businesses and residents of Southeast Alaska well into the future.

To accomplish the objectives of the KPTL Study, the primary tasks undertaken have been to:

(1) provide an updated assessment of the previously identified route alternatives for the KPTL;
(2) evaluate other route alternatives as appropriate that can provide power supply to Woewodski Island and other locations in the area;
(3) estimate the capital and operating costs associated with each alternative;
(4) evaluate and define power supply requirements and regional generation capability in the region;

(5) outline permitting and environmental issues associated with development of the KPTL;
(6) evaluate load flows and electrical system configuration requirements to assure the reliable operation of the interconnected regional system;
(7) estimate the costs of power to the interconnected load centers with and without the inclusion of each KPTL route alternative over a multi-year forecast period.

For the purpose of the economic analysis included in Item 7, it has been assumed that KPTL construction costs will be funded with grants, pursuant to the plans of the Southeast Conference. Although the capital costs are expected to be mostly grant funded, the annual costs of operating and maintaining the KPTL as well as funding a reserve for long-term renewals and replacements is to be borne by the users of the KPTL.

Because of the importance of the KPTL system to the general economic well-being of Southeast Alaska, it is very important that a wide representation of community, utility, tribal, government agency and other organizations have the opportunity to contribute to the KPTL Study. A significant amount of on-site field reconnaissance was conducted as part of this study during which time a number of community leaders, local and state planners, agency representatives, and local contractors were interviewed. Representatives of the mining interests on Woewodski Island were also interviewed. We have relied extensively upon the input from all of these sources in preparing the study.

It should be noted that the economic analysis conducted as part of the KPTL Study looked only at the cost of power production in Kake by the proposed transmission system. The cost of power production is typically the most significant component of an electric utility's revenue requirement; however, there are other costs that figure significantly into the basis for electric rates that are charged to retail customers. Although the cost of power production may be reduced through alternative means of power supply, other costs may continue to keep retail rates at a high level. The State's Power Cost Equalization (PCE)[1] program also affects how much of the benefit of lower production costs ultimately reach the electric consumer. Aside from the estimation of power production costs, the KPTL Study has not attempted to evaluate retail electric rates in Kake or elsewhere in Southeast Alaska.

Study Approach

Although previous studies were reviewed and considered in the preparation of the KPTL Study, a significant amount of new work was conducted. During the field reconnaissance conducted in September 2004, all possible routes of the KPTL were considered. In this manner, a fresh look was taken at the route alternatives with no restrictions placed on the evaluation because of recommendations from previous studies. A completely revised estimate of the costs to construct

[1] The Power Cost Equalization (PCE) program subsidizes retail electric rates for residential customers and public facilities in qualifying communities. The funding of the PCE program is granted by the State legislature on an annual basis and no guarantees can be provided with regard to its continuation in the future. An endowment was created in 2002 to fund the PCE program using funds from the divestiture of the Four Dam Pool and other funds including a legislative appropriation of $100 million from the Constitutional Budget Reserve and funds from unused Intertie loans.

the KPTL was also prepared as part of the KPTL Study. The six route alternatives that were evaluated are summarized as follows:

- *Northern Alternative* – (66.0 miles total length, one 3.1 mile marine crossing) Generally located at the north end of Kupreanof Island, previously defined as the Northern Alternative in the 2003 Intertie Study. For the most part, this route follows the most likely route of a permanent road between Kake and Petersburg as defined in the Southeast Alaska Transportation Plan (SATP) dated August 2004.

- *Center-North Alternative* – (59.0 miles total length, one 0.6 mile long marine crossing) Connects to the existing Tyee transmission line south of Petersburg, crosses Wrangell Narrows, proceeds west across and then north on the Lindenberg Peninsula through the Petersburg Creek-Duncan Salt Chuck Wilderness where it intersects with the route of the Northern Alternative. Also referred to as the Wilderness Route.
- *Center-Center Alternative* – (51.4 miles total length, two marine crossings totaling 5.5 miles) Originates at the same location near Petersburg as the Center-North route but continues northwest toward Kake across Duncan Canal rather than passing through the Wilderness area.
- *Center-South Alternative* – (51.7 miles total length, two marine crossings totaling 1.6 miles) Similar to Center-Center route but crosses Duncan Canal at a point farther south on the canal. This route was defined in previous studies as the Southern Alternative and is also referred to as the Tonka-Duncan Canal route.

- *Southern Woewodski Alternative* – (75.7 miles total length, two marine crossings totaling 1.5 miles) Connects to the existing Tyee transmission line near the south end of Mitkof Island, proceeds west along the south end of Mitkof Island, crosses Wrangell Narrows to Woewodski Island and continues west across Woewodski Island, crosses Duncan Canal to south Kupreanof Island and then proceeds northwest up the length of Kupreanof Island to Kake. Along much of its route on Kupreanof Island, the Southern Woewodski Alternative follows existing USFS roads. The SATP also identifies a permanent road route between Kake and Totem Bay on south Kupreanof Island along part of the length of this corridor.

- *Woewodski Tap Alternative* – (13.6 miles total length, one 0.9 mile long marine crossing) This alternative is an extension of the Center-South/Center/North route that proceeds from a point just west of Wrangell Narrows south on the Lindenberg Peninsula where it crosses to Woewodski Island. The Woewodski Tap would be constructed at a later time only if a mining facility were to be developed.

In conducting the KPTL Study, significant new information was gathered from on-site investigations, routes were identified and diagrammed, previous studies were obtained and reviewed, data was obtained from material and service vendors, and discussions were held with a number of utility, community, and government representatives. The technical review included consideration of the line route, system configuration, design criteria, and cost and factored in the experience of several specialists familiar with road and transmission construction in Southeast

Alaska. A detailed preliminary design of the KPTL system was developed using specialized computer design software.

In conducting the economic analysis for the KPTL Study, terms and conditions of existing contracts and agreements have been acknowledged to assure that the analysis appropriately models the commercial environment in which the KPTL will operate. The question then becomes, is the KPTL economically justifiable from the perspective of IPEC and its ratepayers[2]. Many transmission and power supply studies in the past have looked at economic viability from a regional or possibly even a "societal" basis. As previously indicated, it has been assumed[3] that the KPTL will be grant funded and will have no capital recovery component associated with its future cost structure.

This study has been prepared in association with two other firms. Commonwealth Associates, Inc. was responsible for the field reconnaissance, review of overhead transmission routes and cost estimates; and CH2M-Hill reviewed permitting requirements and the environmental documentation process and prepared an estimate of the cost and time to conduct the necessary environmental studies, complete the National Environmental Policy Act (NEPA) process, and obtain the necessary approvals and permits needed to construct the KPTL. D. Hittle & Associates had primary responsibility for the power supply and economic analyses and for overall coordination of the study effort.

It should also be understood that the KPTL Study is a feasibility assessment. The technical information and cost estimates presented in this report are subject to change as more additional studies are conducted and more information is obtained. Actual design of the KPTL, if pursued in the future, will provide much more detailed specification of the system components, routes and configuration and allow for greater precision on estimating costs. The actual cost of constructing the KPTL, however, will be subject to a number of factors including market conditions at the time bids for material and construction services are requested.

Status of Transmission Development in Southeast Alaska

Since completion of the 2003 Intertie Study, there have been a number of developments with regard to transmission lines in Southeast Alaska. Ketchikan Public Utilities (KPU) transferred its ownership and management of the Swan – Tyee Intertie to the Four Dam Pool Power Agency (FDPPA) in 2004. Although approximately 18 miles of the right-of-way was cleared in 2002, nearly all of the clearing was completed in 2004 and initiation of structure foundation installation also began in 2004. In the fall of 2004, funding sources for the Swan-Tyee Intertie were depleted and the FDPPA stopped construction. No date has been provided as to when or if construction of the Swan-Tyee Intertie will be restarted. The Swan – Tyee line in total will be approximately 57 miles in length and entirely of overhead construction with no submarine crossings. It will be constructed for 138-kV nominal voltage but will be operated initially at 69-kV.

[2] KWETICO, as the future owner/operator of the KPTL will also need to determine economic justification, however, this justification will be based on the estimated impacts on IPEC's ratepayers, the ultimate end-users of the KPTL.
[3] This assumption has been provided by the Southeast Conference.

Alaska Electric Light & Power (AELP) has undertaken the construction of the 69-kV Juneau – Greens Creek segment of the Juneau-Hoonah Intertie. This line will be owned by KWETICO but is being constructed and will be operated by AELP as the agent for KWETICO. Design and permitting of the line is complete and construction of the overhead portion of the line on Admiralty Island between Young Bay and Hawk Inlet was completed in 2004. The submarine cable between Douglas Island and Admiralty Island will be installed in August 2005. The substation at the mine and the section of overhead line between Hawk Inlet and the mine should also be completed later in 2005. Most of the grant funding requirement for this line has been secured.

On the Canadian side of the border, it has been indicated that BC Hydro is considering the construction of a 110 mile-long 138-kV transmission line from Meziadin Junction (northeast of Stewart, B.C.) to a location near the proposed Forrest Kerr Hydroelectric Project on the Iskut River. This will bring the BC Hydro system to within approximately 25 miles of the Alaska border on the Bradfield Canal corridor. In the past, there have been studies conducted with regard to constructing transmission interconnections between British Columbia and Alaska. Proposals have been made by the State and others to construct a transmission line from Alaska to Canada in conjunction with a potential road along the Bradfield Canal. A transmission interconnection with BC Hydro could provide access to power markets outside Southeast Alaska for the output of regional hydroelectric generation.

Elsewhere in Southeast Alaska, Alaska Power & Telephone (AP&T) will be completing the South Fork hydroelectric project on Prince of Wales Island during the summer of 2005. AP&T also indicated that it expects to begin construction activities on the Kasidaya Creek hydroelectric project near Skagway in the near future. This project will serve the interconnected service areas of Haines and Skagway. Gustavus Electric Company received its FERC license for the Falls Creek hydroelectric project near Gustavus and expects to begin construction in 2006. Preliminary scoping for the Thayer Lake hydroelectric project near Angoon has begun. As previously indicated, AEL&P is constructing the transmission line to Admiralty Island at the present time. AEL&P has received its FERC license for the Lake Dorothy hydroelectric project and expects to construct this project in the near future.

Conclusions

The following conclusions are offered with regard to the KPTL Study. Although these conclusions are offered at this point in the report, it is important to understand the assumptions and other factors described in subsequent sections of this report that contribute to the conclusions.

1. Six proposed routes for the KPTL have been identified and reviewed as part of this study. Two of these, the Northern and Center-South Alternative have been studied extensively in the past. The Center-South (old "Southern" route) Alternative has been the preferred alternative from a cost and constructability perspective in previous studies. The Center-

South Alternative has also been selected as the preferred route by the Kake – Petersburg Intertie Steering Committee[4] as a result of the KPTL Study. (See Exhibit 1)

2. Forest Service roads exist along the majority of the length of most of the proposed routes. Construction of the KPTL adjacent to these roads, to the extent possible, should provide for lower costs of construction and maintenance. Single wood pole structures are preferred for placement along roads.

3. The recommended voltage for the KPTL is 69-kV. This voltage more than accommodates the Kake electrical requirement and will be sufficient if a connection is to be made at a later date to a mining facility on Woewodski Island. This voltage will also accommodate the estimated power loadings if a transmission interconnection between Kake and Sitka is eventually developed.

4. The recommended overhead conductor for the KPTL is 336 ACSR. Submarine cables should be 3-phase, copper 4/0 conductor bundled cables. A 24 strand fiber optic communication line is recommended to be included for the length of the KPTL and will be bundled in to the submarine cable.

5. The estimated costs of developing and constructing the KPTL, including all direct and indirect costs, range between $30.3 million for the Center-South Alternative and $42.3 million for the Southern Woewodski Alernative. The estimated cost to construct the Woewodski Tap Alternative, which would only be constructed in the future if a mining operation is developed on Woewodski Island, is $8.3 million.

6. Energy generation capability is projected to be available from the Four Dam Pool Power Agency's Lake Tyee hydroelectric project to sell to IPEC for use in Kake if the KPTL is constructed. It is also estimated that power would be available from the Lake Tyee Project to supply the majority of the assumed power supply needs of a potential mining facility on Woewodski Island. A power sales contract will need to be negotiated with the Four Dam Pool Power Agency if power is to be sold to either IPEC or a mining facility.

7. Assuming that construction and development costs of the KPTL is grant funded and that reasonable power supply contracts can be arranged, IPEC should be able to realize savings in its costs of power supply in Kake with the KPTL when compared to continued diesel-fueled power generation.

8. The annual costs to operate, maintain and administer the KPTL can be reasonably recovered through charges for transmission services or, bundled in with the delivered cost of power.

9. The estimated net present value in savings to IPEC over the 20 year period 2009-2028 with the KPTL is $1.3 million. If a mining operation on Woewodski Island is developed in the future (assumed to be 2012 for this study) the net present value savings to IPEC

[4] Committee members were Dave Carlson, Southeast Conference; Gary Williams, Organized Village of Kake; Ted Smith, City of Petersburg; Bob LeResche, Four Dam Pool Power Agency; Dick Olson, Thomas Bay Power Authority; Paul Reese, City of Kake.

would be $3.8 million due to the allocation of a portion of the KPTL operating costs to the mine.

10. With the Interties, IPEC may be able to offer economic incentive rates in Kake, with certain limitations, to encourage new commercial activity. The economic incentive rates could be tied to the cost of purchased power with a nominal margin.

A comparative matrix of the characteristics, costs and other evaluation criteria is provided as Figure 1-1. A map of the Southeast Alaska Intertie system as it presently exists with proposed new lines, is provided in Figure 1-2. The route alternatives for the KPTL are shown in Figure 2-1.

FIGURE 1-1
Kake - Petersburg Transmission Line
Comparative Evaluation of Alternative Routes

Evaluation Criteria	Northern	Center-North (Wilderness)	Center-Center	Center-South (Old South Route)	Southern - Woewodski	Woewodski Tap [1]
Total Length (miles)	66.0	59.0	51.3	51.6	75.7	13.5
Overhead Length (miles)	62.9	58.4	45.8	50.0	74.2	12.6
Length Along Existing Roads (miles)	40.5	41.0	42.9	36.9	49.7	2.1
Length Along Existing Roads (%)	64%	70%	94%	74%	67%	17%
Number of Marine Crossings	One	One	Two	Two	Two	One
Total Length of Marine Crossings (miles)	3.1	0.6	5.5	1.6	1.5	0.9
Estimated Direct Cost (millions)	$ 29.0	$ 25.3	$ 25.5	$ 22.5	$ 31.9	$ 7.3
% Above Lowest Cost Alternative	29%	12%	13%	0%	42%	
Estimated Indirect Cost (millions) [2]	$ 9.6	$ 9.0	$ 8.6	$ 7.8	$ 10.4	$ 2.7
Estimated Total Cost (millions)	$ 38.7	$ 34.3	$ 34.1	$ 30.2	$ 42.3	$ 10.1
Estimated Total Unit Cost ($/mile) [3]	$ 586	$ 581	$ 665	$ 586	$ 559	$ 744.5
Construction Access from Existing Roads	Medium	Medium	Good	Good	Medium	Poor
Route Adjacent to Proposed Future Year-Round State Road Routes	Yes	Partial [4]	No	No	Partial [5]	No
For Following Comparisons, "Low" rating is preferable. [6]						
Relative General Construction Difficulty	Medium-High	Medium	Medium	Medium	Medium-High	Medium
Submarine Cable General Proximity to Commercial/Recreational Fisheries [7]	Low	Low	Medium-High	Medium	Low	Low
Submarine Cable Vulnerable to Impact from Marine Traffic	Medium	Medium-High	Medium-High	Medium-High	Medium	Medium
Expected Level of Service Interruptions [8]	Medium	Low	Low	Low	Medium	Low
Relative Annual Cost of Maintenance [9]	Medium	Low	Low	Low	Medium	Low
Permitting Difficulty/Cost - Estimated Permitting Cost ($000)	Medium ($761)	High ($1,078)	Medium-Low ($655)	Medium-Low ($655)	Medium ($761)	Low ($400)
Impact on Scenic Viewsheds	Medium-High	Low	Low	Low	Low	Low
Potential Conflict with Known Archeological Sites	Medium	Medium	Low	Low	Medium	Medium
Anadromous Fish Stream Crossings	Medium	Medium	Medium	Medium	Medium	Low
Potential Conflict with Areas of Potential ADF&G Concern	Medium	Medium	Medium	Medium	Medium	Low
Location of Route Relative to Old Growth Forests	Medium	Medium	Medium	Medium	Medium	Low
Potential Conflicts with Land Use Designations	Low	High	Low	Low	Medium	Low

FIGURE 1-1
Kake - Petersburg Transmission Line
Comparative Evaluation of Alternative Routes

NOTES:

[1] The Woewodski Tap is not a transmission interconnection between Petersburg and Kake.

[2] Includes costs of permitting, engineering, design, construction management, owner's administration and contingencies.

[3] Estimated Total Cost divided by Total Length.

[4] The segment of the Center-North route to the north and west of the Wilderness area, follows the route of the Kake - Petersburg road as proposed in the SATP.

[5] A road extending south of Kake to the south end of Kupreanof Island has been proposed in the SATP. The transmission line would follow this road route for part of its length.

[6] Ratings are provided for comparison of alternatives only and are not meant to serve as an indication of absolute impacts.

[7] In areas with active fisheries, it may be necessary to bury submarine cables in trenches as well as conduct installation within specific windows of time.

[8] In general, all routes should provide highly reliable service. Portions of the Northern and Southern Woewodski routes are in more rugged territory, however, and as such could be subject to a slightly higher probability of outage due to environmental factors.

[9] Annual maintenance costs should be reasonably comparable for all routes but will most likely be slightly higher for the Northern and Southern Woewodski routes due to various factors including more rugged terrain, length of line and reduced road access.

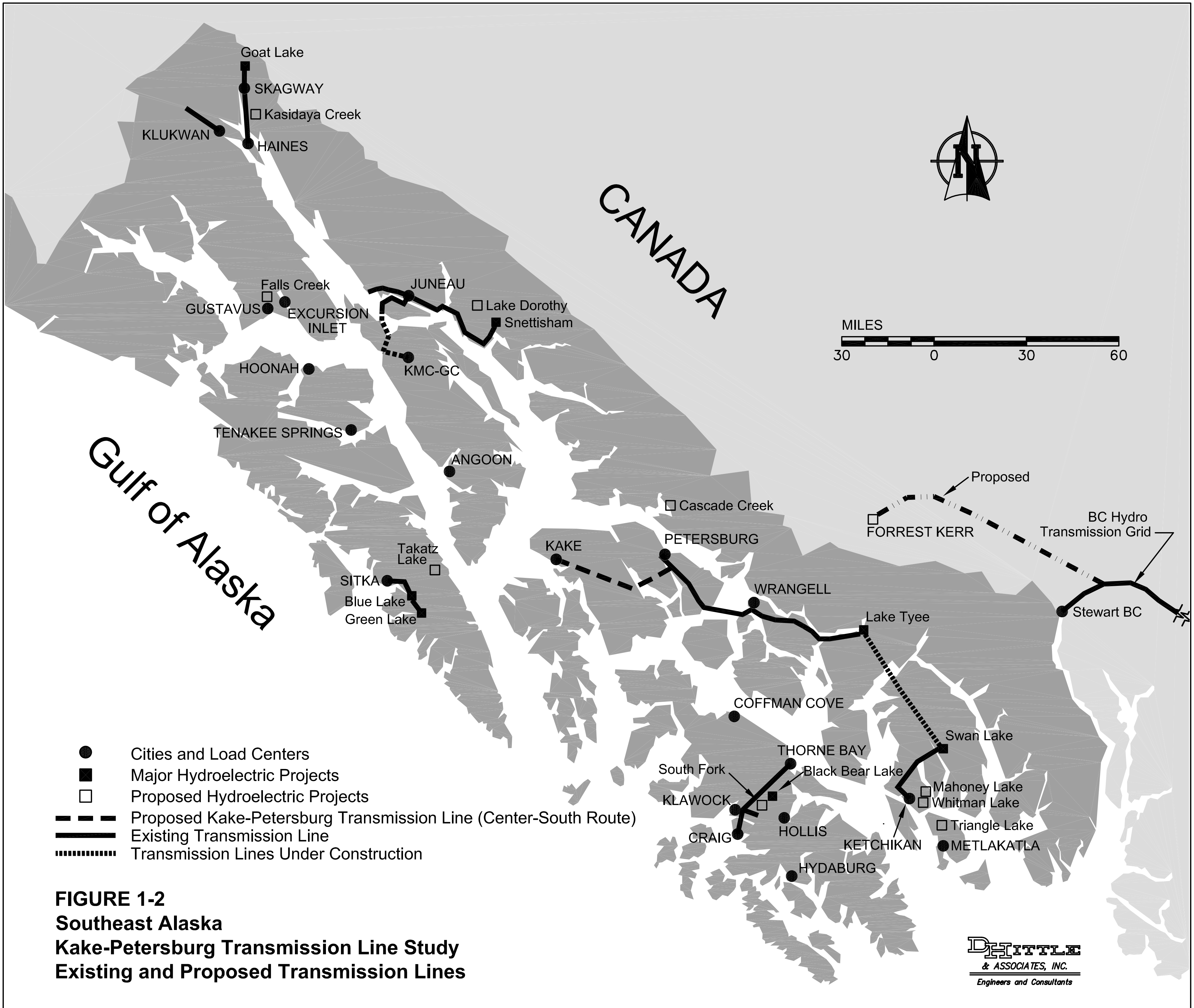


FIGURE 1-2
Southeast Alaska
Kake-Petersburg Transmission Line Study
Existing and Proposed Transmission Lines

Kake/Petersburg Intertie Segment Planning Study
Steering Committee Finding and Recommendation

In July of 2004, Southeast Conference received a $200,000 grant from the Denali Commission to conduct a Planning Study for the proposed Kake to Petersburg Intertie Segment. This proposed transmission line segment will interconnect the City of Kake with the existing transmission line system serving Petersburg and Wrangell with Lake Tyee hydroelectric power. The Kake/Petersburg segment is part of the Southeast Alaska Intertie Project and will eventually be extended to Sitka.

A Steering Committee was formed to oversee and guide the Planning Study which was awarded to D. Hittle & Associates. The Steering Committee included representatives from Kake and Petersburg, Inside Passage Electric Cooperative, the Thomas Bay Power Authority, and the Four Dam Pool Power Agency. One principle goal of the study was to identify and analyze the various route alternatives for the transmission line between Petersburg and Kake. The Steering Committee met several times during the study period to review and 'screen-out' various route alternatives.

On July 18, 2005, the Steering Committee met and unanimously selected the 'Center-South' route as the 'Proposed Action' or preferred route for the transmission line between Kake and Petersburg.

The Steering Committee acknowledged that an Environmental Impact Statement (EIS) will most likely be required for this project and other alternate routes considered in the Planning Study will be evaluated as part of this process. While the Planning Study specifically focused on the transmission line and alternate routes for the line, the Steering Committee also acknowledged the State of Alaska's future plans to interconnect the two communities with a road link. After a meeting with Forest Service and State of Alaska officials, the Steering Committee felt that these issues would be raised and addressed during the permitting process which could include either an Environmental Assessment (EA) or an Environmental Impact Statement (EIS).

Kake to Petersburg Steering Committee members:
Mayor Ted Smith – City of Petersburg
Mayor Paul Reese – City of Kake
Gary Williams – Organized Village of Kake
Vern Rauscher – Inside Passage Electric Cooperative
Bob LeResche – Four Dam Pool Power Agency
Dick Olson – Thomas Bay Power Authority

Transmission Line Route Alternatives and Technical Characteristics

Introduction

The Petersburg - Kake transmission line ("KPTL") will interconnect the community of Kake on Kupreanof Island to the interconnected electric systems of Petersburg and Wrangell. Petersburg and Wrangell are connected to and purchase most of their respective power supplies from the Lake Tyee hydroelectric project owned by the FDPPA. The KPTL will be used to transmit surplus hydroelectric power purchased from the FDPPA to IPEC's electric system in Kake, thereby offsetting diesel generation in Kake.

The KPTL has been studied in reasonable detail in the past, most recently in the 2003 Intertie Study and in 1996 with a feasibility study prepared by R.W. Beck for the State of Alaska, Department of Community Affairs, Division of Energy (the "1996 Feasibility Study"). The 1996 Feasibility Study was a follow-on to the 1987 Southeast Alaska Transmission Intertie Study prepared for the Alaska Power Authority by the Harza Engineering Company (the "1987 Intertie Study").

The 2003 Intertie Study, the 1987 Intertie Study and the 1996 Feasibility Study identified two primary routes for the line. One alternative route goes to the north of the Petersburg Creek – Duncan Salt Chuck Wilderness Area, while the other route goes to the south of the Wilderness Area. These two route alternatives were previously defined as the Southern and Northern route alternatives. In all three of the previous studies, the southern route alternative was preferred because of its shorter length, lower estimated construction cost and generally lesser expected environmental impact. The Northern route, although estimated to be more expensive to construct, was considered to follow the likely corridor of a year-round maintained road between Kake and Petersburg.

With the possibility of a major mining operation on Woewodski Island, additional routes for the KPTL were considered that could facilitate power deliveries to a mine if it were to be developed. Further, the possibility of a route through the western most side of the Petersburg Creek-Duncan Salt Chuck Wilderness parallel to Duncan Canal, was also considered because of the generally easy topography that would simplify construction of a transmission line as well as a road.

Each of the alternative routes was defined with regard to specific location, topography, availability of adjacent USFS roads, vegetation, marine crossings, and general construction requirements. A map of the routes was prepared that separated each route into multiple segments noted by identifying nodes. The lengths of each segment were then determined and used to establish a screening level cost estimate for each route. The screening level cost estimate was used by the Kake to Petersburg Intertie Steering Committee to identity the routes best suited for further review. This section of the report describes the basic criteria used in evaluating the various routes and the results of the screening level assessment.

At the present time, the Four Dam Pool Power Agency is constructing a transmission line to interconnect Ketchikan's electric system with the Tyee-Wrangell-Petersburg (TWP) electric system. This new interconnection will provide Ketchikan with access to the surplus generation capability of the Lake Tyee hydroelectric project. Although Kake's power requirements from the Lake Tyee project will be subordinate to the requirements of Petersburg, Wrangell and Ketchikan, current forecasts indicate that sufficient energy should be available to supply Kake's load for several years in to the future. If the transmission interconnection to Ketchikan is completed, additional hydroelectric resources could be available to supply Kake's power requirements in the future.

Alternative Route Assessment

From the broad prospective our task was to evaluate potential routes for the KPTL including, but not limited to, the previously defined Northern Alternative and Southern Alternative from an overall cost and benefit perspective. With the possibility of a new mining operation on Woewodski Island, the potential for extending the KPTL to Woewodski Island is an important option in that it could provide significant opportunity in the future to sell surplus hydroelectric power available in Southeast Alaska to the mine. In the past, most mining operations in Alaska have been self-generators of electric power. The KPTL study must also evaluate the options for extending the transmission line to or though this potential mine location.

Our detailed scope and mission was to take a "fresh" look at the terrain, availability of existing roads along the potential KPTL routes, and visit with the local contractors, residents of Kake, Petersburg, and government agencies such as the United States Forest Service (USFS) represented locally by the Petersburg District Ranger. In addition, and different from previous studies, the KPTL study was to also evaluate routes that could possibly extend the transmission line to or through the potential mine location on Woewodski Island (mine).

Route Alignment Criteria

General locations for the alternative routes were defined based on past studies, topography and other physical constraints. More specific criteria, as follows, were used to further refine the route locations.

- Generally parallel existing roads where possible
- Consider route location(s) where new service roads could be constructed
- Avoid disruption to known fisheries, aviation, and marine traffic
- Provide for submarine cable crossings that avoid dredging areas, commercial fishing areas, and major rock outcrops and are accessible to shore terminals
- Maintain a minimum distance of 330 feet from known nesting areas of eagles.
- Avoid and minimize impacts on scenic viewsheds
- Avoid and minimize, where possible, known muskeg or other wetland areas
- Maximize ground accessibility for maintenance purposes

During the evaluation of the alternative routes, Don Koenigs, a local consultant with previous experience in logging and road building in the Tongass National Forest was included on our team. In addition, residents and officials of Kake were consulted as to Native traditions and traditional uses of the potentially affected land areas in and around Kake.

Field Evaluation of Alternative Routes

In September 2004, two Commonwealth Associates, Inc. (CAI) engineers, knowledgeable in transmission design and construction practices of Southeast Alaska spent one week in the field to gain first-hand information with regard to the general project vicinity. This field evaluation involved aerial reconnaissance of the area, driving USFS roads, meeting with local officials, and documenting various alternative routes. The process attempted to capture all reasonable routes that would be further studied and screened for viability. The CAI engineers were accompanied by a local consultant, Don Koenigs, and Dave Carlson, Southeast Conference Intertie Coordinator, during the field investigations.

In addition to the aerial and ground reconnaissance, several meetings were held in Kake listening to the issues expressed by the Kake Village leaders, merchants, and utility personnel from IPEC. Time was also spent in Petersburg meeting with USFS personnel, Petersburg community leaders and officials, and the Superintendent of Petersburg Municipal Power & Light.

Both fixed wing aircraft and a helicopter were chartered for four days to capture on video and digital camera ten potential routes. The helicopter was also used to land at certain locations not accessible by road. The engineering team spent two days driving the many logging roads out of Kake and another day driving roads accessible from Petersburg. Maps provided by the USFS proved to be essential in navigating the vast road network on Kupreanof Island. Our immediate observation was that the road system was in excellent condition and would provide a wide corridor to facilitate construction and maintenance of a transmission line. The existing road network appeared to be a valuable asset to build a power line. The vast road network also provided many choices to study and select the best right-of-way.

Particular attention was given to the observation and study of proposed submarine cable locations. The initial study effort was to try and minimize marine crossings and if required to study their location and determine their use from a commercial fishing, sport fishing, types of commercial vessel traffic, tides, dredging activity, and depth of water.

The majority of the land involved along the potential routes is federal land administered by the USFS. Some State land would also be crossed for certain alternative routes. Closer to Kake, the routes cross private property and tribal lands owned by the Village of Kake. Marine crossings are across bodies of water governed by the State.

Initial Screening Assessment of Alternative Routes

A wide area was investigated during the field survey. Following the field investigations, ten alternative routes were defined, as follows:

1. Northern
2. Center – South
3. Center – North
4. Center – Center
5. Center – Woewodski Tap
6. Southern – Woewodski
7. Upper Duncan Canal
8. Petersburg To Kake (Submarine Cable)
9. Petersburg Creek
10. Southern – Woewodski Tap (Submarine Cable)

The ten alternative routes were documented on the December 23, 2004 map that was prepared and presented to the Kake to Petersburg Intertie Steering Committee in a meeting on January 12, 2005 for consideration. Two of these routes, Alternative 8 and Alternative 10, involved extensive lengths of submarine cable and were removed from further consideration due to expected higher costs. Alternative 9, along Petersburg Creek on Kupreanof Island, was considered impractical due to the sensitive environment in this area. Alternative 7 was also removed from consideration because it would involve a lengthy submarine cable in the northern region of Duncan Canal. As a result of these factors and the discussions conducted in the January meeting, the original ten alternative routes were reduced to six alternatives for further evaluation.

The six KPTL alternatives are defined as follows:

- *Northern Alternative* – (66.0 miles total length, one 3.1 mile marine crossing) Generally located at the north end of Kupreanof Island, previously defined as the Northern Alternative in the 2003 Intertie Study. For the most part, this route follows the route of a permanent road between Kake and Petersburg as defined in the Southeast Alaska Transportation Plan (SATP) dated August 2004.

- *Center-North Alternative* – (59.0 miles total length, one 0.6 mile long marine crossing) Connects to the existing Tyee transmission line south of Petersburg, crosses Wrangell Narrows, proceeds west across and then north on the Lindenberg Peninsula through the Petersburg Creek-Duncan Salt Chuck Wilderness where it intersects with the route of the Northern Alternative. The Center-North Alternative is also referred to as the Wilderness Route.

- *Center-Center Alternative* – (51.4 miles total length, two marine crossings totaling 5.5 miles) Originates at the same location near Petersburg as the Center-North route but continues northwest toward Kake across Duncan Canal rather than passing through the Wilderness area.

- *Center-South Alternative* – (51.7 miles total length, two marine crossings totaling 1.6 miles) Similar to Center-Center route but crosses Duncan Canal at a point farther south on the canal. This route was defined in previous studies as the Southern Alternative and is also referred to as the Tonka-Duncan Canal route.

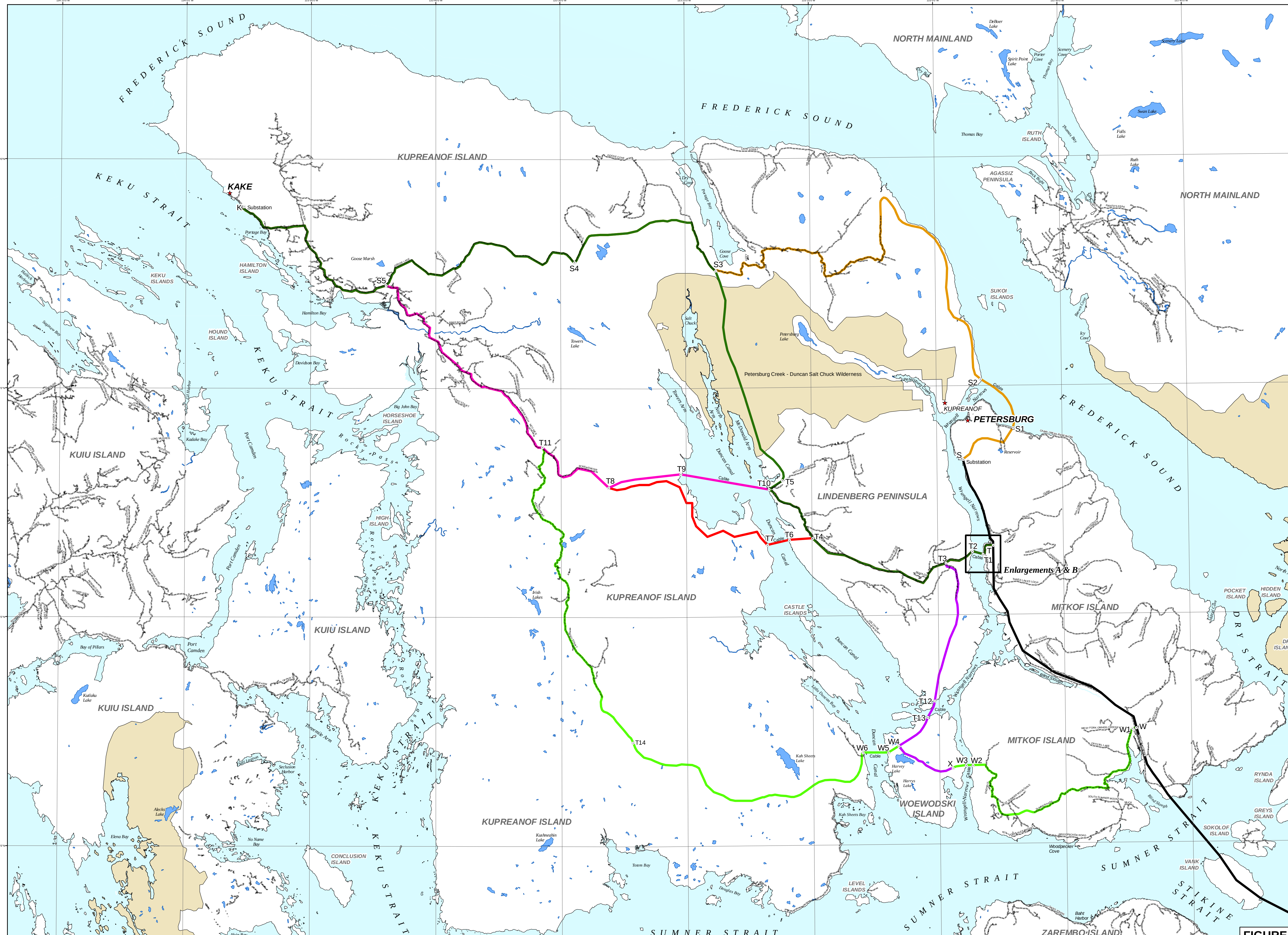
- *Southern Woewodski Alternative* – (75.7 miles total length, two marine crossings totaling 1.5 miles) Connects to the existing Tyee transmission line near the south end of Mitkof Island, proceeds west along the south end of Mitkof Island, crosses Wrangell Narrows to Woewodski Island and continues west across Woewodski Island, crosses Duncan Canal to south Kupreanof Island and then proceeds northwest up the length of Kupreanof Island to Kake. Along much of its route on Kupreanof Island, the Southern Woewodski Alternative follows existing USFS roads. The SATP also identifies a permanent road between Kake and south Kupreanof Island along this corridor.

- *Woewodski Tap Alternative* – (13.6 miles total length, one 0.9 mile long marine crossing) This alternative is an extension of the Center-South/Center/North route that proceeds from a point just west of Wrangell Narrows south on the Lindenberg Peninsula where it crosses to Woewodski Island. The Woewodski Tap would be constructed at a later time only if a mining facility were to be developed. The cost estimate for the Woewodski Tap Alternative included in this report is based on the assumption that one of the Center routes is constructed first to establish the connection to the TWP transmission line and cross Wrangell Narrows. With the Northern Alternative, additional cost would be incurred to extend the Woewodski Tap to the TWP interconnection point.

Each of the alternative routes was defined with regard to specific location, availability of adjacent USFS roads, length trough forested areas, length through muskeg areas, marine crossings, and general construction requirements. A map of the routes was prepared that separated each route into multiple segments noted by identifying nodes. The lengths of each segment were then determined and used to establish a screening level cost estimate for each route.

The six routes are shown on the map in Figure 2-1. The detailed length of each segment of the six alternative routes is shown in Figure 2-2. As can be seen in Figure 2-2, the total lengths of the routes vary between 51.4 miles long for the Center-Center Alternative to 75.7 miles long for the Southern Woewodski Alternative. The Woewodski Tap Alternative is a much shorter length since it will only provide power to Woewodski Island from a tap point along the Center-South/Center/North Alternative.

A "screening level" cost estimate of the six route alternatives was made for the purpose of determining the cost differential of the various routes under consideration. This estimate was not a detailed unit cost analysis but rather, was made using cost data from previous studies, data from Southeast Alaska utilities, regional power agencies, and local contractors. In addition, CAI's general experience with 69-kV transmission line design and construction was also used in



Proposed Route Alternatives (Node-Node Link Segments)

- Center - North (T, T1, T2, T3, T4, T10, T5, S3, S4, S5, K)
- Center - South [Least Expensive] (T, T1, T2, T3, T4, T6, T7, T8, T11, S5, K)
- Center - Woewodski Tap (T, T1, T2, T3, T12, T13, W4, X)
- Northern (S, S1, S2, S3, S4, S5, K)
- Center - Center (T, T1, T2, T3, T4, T10, T9, T8, T11, S5, K)
- Southern - Woewodski (W, W1, W2, W3, X, W4, W5, W6, T14, T11, S5, K)

Link Segment Node

T1 Identification/Node

Basemap Source: US Forest Service, Petersburg Ranger District - Tongass National Forest (spatial vector/tabular data and black & white orthophotography - april 1997). USGS 7.5 minute series topographic quadrangle maps. Commonwealth Associates, Inc. PLS-CADD transmission line and right-of-way alignment models.

Base Map Ground Features

- Shoreline
- USFS Road
- Existing Transmission Line
- Wilderness Boundary
- Fresh Water
- Salt Water

0 10,000 20,000 30,000 40,000 50,000 60,000 Feet

0 2.5 5 7.5 10 12.5 Miles

Horizontal Datum: North American Datum of 1983 (NAD83).
Geographic Coordinate System (GCS): Alaska State Plane.
State Plane Zone: 1.
Federal Information Processing Standard (FIPS) Zone: 5001.
Projection: Hotine Oblique Mercator Azimuth Natural Origin.
Spheroid: Geodetic Reference System of 1980 (GRS 1980).
Linear Unit: US Feet.

Project Area
ALASKA

KAKE TO PETERSBURG TRANSMISSION INTERTIE
Potential 69 kV Transmission Line Route Alternatives

Southeast Conference
D Hittle & Associates, Inc.

April 21, 2005

FIGURE 2-1

Commonwealth Associates Inc.
engineers • consultants • construction managers

FIGURE 2-2
KPTL Segment Lengths and Location Characteristics

CENTER - NORTH ALTERNATIVE ROUTE

Link Segment Node -To- Node	Distance Segment (Feet)	Distance Segment (Miles)	Roads Total (Feet)	Roads Total (Miles)	No Roads Total (Feet)	No Roads Total (Miles)	Roads Forest (Feet)	Roads Forest (Miles)	No Roads Forest (Feet)	No Roads Forest (Miles)	Roads Muskeg (Feet)	Roads Muskeg (Miles)	No Roads Muskeg (Feet)	No Roads Muskeg (Miles)	Roads *Other (Feet)	Roads *Other (Miles)	No Roads *Other (Feet)	No Roads *Other (Miles)	Marine Crossing (Feet)	Marine Crossing (Miles)
T-T1	4,871.3	0.9	3,372.0	0.6	1,499.3	0.3	1,607.7	0.3	1,499.3	0.3	1,764.3	0.3								0.0
T1-T2	2,930.6	0.6																	2,930.6	0.6
T2-T3	7,689.1	1.5	7,689.1	1.5			7,592.0	1.4			97.1									0.0
T3-T4	42,268.3	8.0	42,268.3	8.0			32,766.3	6.2			9,502.0	1.8								0.0
T4-T10	19,225.8	3.6	19,225.8	3.6			15,740.5	3.0			3,485.3	0.7								0.0
T10-T5	4,338.2	0.8	4,338.2	0.8			2,049.0	0.4			2,289.2	0.4								0.0
T5-S3	60,105.9	11.4			60,105.9	11.4			24,779.4	4.7			35,326.5	6.7						0.0
S3-S4	51,454.9	9.7	21,286.3	4.0	30,168.6	5.7			19,533.9	3.7	21,286.3	4.0	10,634.7	2.0						0.0
S4-S5	64,337.7	12.2	64,337.7	12.2			10,662.2	2.0			53,675.5	10.2								0.0
S5-K	54,097.6	10.2	54,097.6	10.2			37,839.7	7.2			3,524.6	0.7			12,733.3	2.4				0.0
	311,319.4	**59.0**	**216,615.0**	**41.0**	**91,773.8**	**17.4**	**108,257.4**	**20.5**	**45,812.6**	**8.7**	**95,624.3**	**18.1**	**45,961.2**	**8.7**	**12,733.3**	**2.4**		**0.0**	**2,930.6**	**0.6**

CENTER - CENTER ALTERNATIVE ROUTE

Link Segment Node -To- Node	Distance Total (Feet)	Distance Total (Miles)	Roads Total (Feet)	Roads Total (Miles)	No Roads Total (Feet)	No Roads Total (Miles)	Roads Forest (Feet)	Roads Forest (Miles)	No Roads Forest (Feet)	No Roads Forest (Miles)	Roads Muskeg (Feet)	Roads Muskeg (Miles)	No Roads Muskeg (Feet)	No Roads Muskeg (Miles)	Roads *Other (Feet)	Roads *Other (Miles)	No Roads *Other (Feet)	No Roads *Other (Miles)	Marine Crossing (Feet)	Marine Crossing (Miles)
T-T1	4,871.3	0.9	3,372.0	0.6	1,499.3	0.3	1,607.7	0.3	1,499.3	0.3	1,764.3	0.3								
T1-T2	2,930.6	0.6																	2,930.6	0.6
T2-T3	7,689.1	1.5	7,689.1	1.5			7,592.0	1.4			97.1	0.0								
T3-T4	42,268.3	8.0	42,268.3	8.0			32,766.3	6.2			9,502.0	1.8								
T4-T10	19,225.8	3.6	19,225.8	3.6			15,740.5	3.0			3,485.3	0.7								
T10-T9	26,094.0	4.9																	26,094.0	4.9
T9-T8	20,004.0	3.8	12,438.6	2.4	7,565.4	1.4			7,565.4	1.4	12,438.6	2.4								
T8-T11	25,111.4	4.8	18,201.9	3.4	6,909.5	1.3	13,980.0	2.6	5,685.2	1.1	4,221.9	0.8	1,224.3	0.2						
T11-S5	68,448.3	13.0	68,448.3	13.0			55,291.7	10.5			12,556.8	2.4			599.8	0.1				
S5-K	54,674.8	10.4	54,674.8	10.4			37,839.7	7.2			4,101.8	0.8			12,733.3	2.4				
	271,317.6	**51.4**	**226,318.8**	**42.9**	**15,974.2**	**3.0**	**164,817.9**	**31.2**	**14,749.9**	**2.8**	**48,167.8**	**9.1**	**1,224.3**	**0.2**	**13,333.1**	**2.5**			**29,024.6**	**5.5**

CENTER - SOUTH ALTERNATIVE ROUTE

Link Segment Node -To- Node	Distance Total (Feet)	Distance Total (Miles)	Roads Total (Feet)	Roads Total (Miles)	No Roads Total (Feet)	No Roads Total (Miles)	Roads Forest (Feet)	Roads Forest (Miles)	No Roads Forest (Feet)	No Roads Forest (Miles)	Roads Muskeg (Feet)	Roads Muskeg (Miles)	No Roads Muskeg (Feet)	No Roads Muskeg (Miles)	Roads *Other (Feet)	Roads *Other (Miles)	No Roads *Other (Feet)	No Roads *Other (Miles)	Marine Crossing (Feet)	Marine Crossing (Miles)
T-T1	4,871.3	0.9	3,372.0	0.6	1,499.3	0.3	1,607.7	0.3	1,499.3	0.3	1,764.3	0.3								
T1-T2	2,930.6	0.6																	2,930.6	0.6
T2-T3	7,689.1	1.5	7,689.1	1.5			7,592.0	1.4			97.1									
T3-T4	42,268.3	8.0	42,268.3	8.0			32,766.3	6.2			9,502.0	1.8								
T4-T6	6,261.5	1.2			6,261.5	1.2			3,161.6	0.6			3,099.9	0.6						
T6-T7	6,428.6	1.2			735.4	0.1			735.4	0.1									5,693.2	1.1
T7-T8	54,322.7	10.3			54,322.7	10.3			19,187.6	3.6			35,135.1	6.7						
T8-T11	25,111.4	4.8	18,201.9	3.4	6,909.5	1.3	13,980.0	2.6	5,685.2	1.1	4,221.9	0.8	1,224.3	0.2						
T11-S5	68,448.3	13.0	68,448.3	13.0			55,291.7	10.5			12,556.8	2.4			599.8	0.1				
S5-K	54,674.8	10.4	54,674.8	10.4			37,839.7	7.2			4,101.8	0.8			12,733.3	2.4				
	273,006.6	**51.7**	**194,654.4**	**36.9**	**69,728.4**	**13.2**	**149,077.4**	**28.2**	**30,269.1**	**5.7**	**32,243.9**	**6.1**	**39,459.3**	**7.5**	**13,333.1**	**2.5**			**8,623.8**	**1.6**

NORTHERN ALTERNATIVE ROUTE

Link Segment Node -To- Node	Distance Total (Feet)	Distance Total (Miles)	Roads Total (Feet)	Roads Total (Miles)	No Roads Total (Feet)	No Roads Total (Miles)	Roads Forest (Feet)	Roads Forest (Miles)	No Roads Forest (Feet)	No Roads Forest (Miles)	Roads Muskeg (Feet)	Roads Muskeg (Miles)	No Roads Muskeg (Feet)	No Roads Muskeg (Miles)	Roads *Other (Feet)	Roads *Other (Miles)	No Roads *Other (Feet)	No Roads *Other (Miles)	Marine Crossing (Feet)	Marine Crossing (Miles)
S-S1	11,506.5	2.2			11,506.5	2.2							10,161.0	1.9			1,345.5	0.3		
S1-S2	16,567.3	3.1																	16,567.3	3.1
S2-S3	150,362.1	28.5	74,335.9	14.1	76,026.2	14.4	39,531.6	7.5	48,906.0	9.3	31,412.2	5.9	26,411.1	5.0	3,392.1	0.6	709.1	0.1		
S3-S4	51,454.9	9.7	21,286.3	4.0	30,168.6	5.7			19,533.9	3.7	21,286.3	4.0	10,634.7	2.0						
S4-S5	64,337.7	12.2	64,337.7	12.2			10,662.2	2.0			53,675.5	10.2								
S5-K	54,097.6	10.2	54,097.6	10.2			37,839.7	7.2			3,524.6	0.7			12,733.3	2.4				
	348,326.1	**66.0**	**214,057.5**	**40.5**	**117,701.3**	**22.3**	**88,033.5**	**16.7**	**68,439.9**	**13.0**	**109,898.6**	**20.8**	**47,206.8**	**8.9**	**16,125.4**	**3.1**	**2,054.6**	**0.4**	**16,567.3**	**3.1**

FIGURE 2-2
KPTL Segment Lengths and Location Characteristics

Link Segment Node -To- Node	Distance Total (Feet)	Distance Total (Miles)	Roads Total (Feet)	Roads Total (Miles)	No Roads Total (Feet)	No Roads Total (Miles)	Roads Forest (Feet)	Roads Forest (Miles)	No Roads Forest (Feet)	No Roads Forest (Miles)	Roads Muskeg (Feet)	Roads Muskeg (Miles)	No Roads Muskeg (Feet)	No Roads Muskeg (Miles)	Roads *Other (Feet)	Roads *Other (Miles)	No Roads *Other (Feet)	No Roads *Other (Miles)	Marine Crossing (Feet)	Marine Crossing (Miles)
SOUTHERN - WOEWODSKI ALTERNATIVE ROUTE																				
W-W1	901.8	0.2	901.8	0.2			901.8	0.2												
W1-W2	71,270.6	13.5	58,485.7	11.1	12,784.9	2.4	33,700.8	6.4	11,068.7	2.1	22,706.9	4.3	1,716.2	0.3	2,078.0	0.4				
W2-W3	1,420.8	0.3																	1,420.8	0.3
W3-X	3,860.5	0.7			3,860.5	0.7			3,860.5	0.7										
X-W4	18,335.9	3.5			18,335.9	3.5			11,124.4	2.1			6,999.4	1.3			212.1	0.0		
W4-W5	3,252.1	0.6			3,252.1	0.6			1,235.4	0.2			2,016.7	0.4						
W5-W6	6,479.4	1.2																	6,479.4	1.2
W6-T14	110,055.6	20.8	34,560.8	6.5	75,494.8	14.3	34,560.8	6.5	24,987.8	4.7			50,507.0	9.6						
T14-T11	61,791.0	11.7	46,079.3	8.7	15,711.7	3.0			4,342.4	0.8	45,747.1	8.7	11,369.3	2.2	332.2	0.1				
T11-S5	68,448.3	13.0	68,448.3	13.0	0.0	0.0	55,291.7	10.5			12,556.8	2.4			599.8	0.1				
S5-K	54,097.6	10.2	54,097.6	10.2	0.0	0.0	37,839.7	7.2			3,524.6	0.7			12,733.3	2.4				
	399,913.6	**75.7**	**262,573.5**	**49.7**	**129,439.9**	**24.5**	**162,294.8**	**30.7**	**56,619.2**	**10.7**	**84,535.4**	**16.0**	**72,608.6**	**13.8**	**15,743.3**	**3.0**	**212.1**	**0.0**	**7,900.2**	**1.5**
CENTER - WOEWODSKI TAP ALTERNATIVE ROUTE																				
Link Segment Node -To- Node	Distance Total (Feet)	Distance Total (Miles)	Roads Total (Feet)	Roads Total (Miles)	No Roads Total (Feet)	No Roads Total (Miles)	Roads Forest (Feet)	Roads Forest (Miles)	No Roads Forest (Feet)	No Roads Forest (Miles)	Roads Muskeg (Feet)	Roads Muskeg (Miles)	No Roads Muskeg (Feet)	No Roads Muskeg (Miles)	Roads *Other (Feet)	Roads *Other (Miles)	No Roads *Other (Feet)	No Roads *Other (Miles)	Marine Crossing (Feet)	Marine Crossing (Miles)
T-T1	4,871.3	0.9	3,372.0	0.6	1,499.3	0.3	1,607.7	0.3	1,499.3	0.3	1,764.3	0.3								
T1-T2	2,630.6	0.6																	2,630.6	0.6
T2-T3	7,689.1	1.5	7,689.1	1.5			7,592.0	1.4			97.1	0.0								
T3-T12	39,981.3	7.6	10,841.7	2.1	29,139.6	5.5	9,054.7	1.7	9,518.0	1.8	1,787.0	0.3	19,621.6	3.7						
T12-T13	4,598.2	0.9																	4,598.2	0.9
T13-W4	10,298.2	2.0			10,298.2	2.0			3,871.3	0.7			6,426.9	1.2						
W4-X	16,850.2	3.2			16,850.2	3.2			9,631.9	1.8			6,991.4	1.3			226.9	0.0		
	86,918.9	**16.6**	**21,902.8**	**4.1**	**57,787.3**	**10.9**	**18,254.4**	**3.5**	**24,520.5**	**4.6**	**3,648.4**	**0.7**	**33,039.9**	**6.3**			**226.9**	**0.0**	**7,228.8**	**1.5**

Note: All distances are approximate.

**Other category includes non-national forest land, overhead stream crossings and various terrains not suitable for muskeg or forest growth.*

the screening level estimates. The "screening level" cost estimate used the same general cost estimating established comparable costs of the alternative routes using the same general

The results of the screening level cost estimate are shown in Table 2-1. It should be noted that the screening level cost estimates do not include certain cost items, such as indirect costs, which when totaled in, would add significantly to the total estimated cost of the alternatives. Further, significant refinement has been made to the cost estimates since the time of the screening level estimate.

TABLE 2-1
Kake - Petersburg Transmission Line
PRELIMINARY Screening Level Cost Estimate of Alternative Routes [1]
($000)

	Route Alternative					
	Northern (Old "Northern")	Center-North ("Wilderness")	Center-Center	Center-South (Old "Southern")	South Woewodski	Woewodski Tap [2]
Overhead Lines	$ 16,354	$ 15,072	$ 12,307	$ 12,307	$ 18,980	$ 3,503
Marine Crossings	4,354	1,876	10,061	3,292	3,292	2,278
Right of Way Clearings	3,164	2,160	2,296	3,052	3,640	2,100
Road Construction	2,701	1,535	578	2,310	4,533	1,295
Helicopter Assistance	726	726	726	726	726	182
Total	$ 27,298	$ 21,368	$ 25,968	$ 21,687	$ 31,170	$ 9,357
% Above Lowest Cost Alt.	28%	0%	22%	1%	46%	
Total Length (miles)	66.0	59.0	51.3	51.6	75.7	13.5

[1] Screening level cost estimates exclude a number of items that could contribute significantly to the overall total cost of the KPTL. These excluded costs are expected to be relatively consistent among the alternatives.

[2] The Woewodski Tap alternative is to be connected to the Center-South/Center/North alternative route at a point approximately three miles west of the origination of the KPTL line at the existing Tyee line. The Woewodski Tap is not in itself a comparable alternative for the KPTL.

As can be seen in Table 2-1, the lowest cost alternative at the time of the screening assessment was the Center-North Alternative, although the Center-South Alternative has a total estimated cost that is almost as low. The other three alternatives are estimated to cost noticeably more, with the South Woewodski being the most costly.

At a meeting with the Kake to Petersburg Intertie Steering Committee on February 25, 2005, the screening level cost estimates were presented and it was determined that the Center-Center and South Woewodski Alternatives would be removed from further consideration. Further, the Northern Alternative was noted to be significantly more costly but the Committee indicated that further cost evaluation of the Northern Route should be conducted because this route follows the route of the year-round road between Kake and Petersburg as identified in the State's SATP. As a result of the discussions during the February 25, 2005 meeting, the route alternatives for further evaluation were defined as:

1. Center – North Alternative (Wilderness Route)
2. Center – South Alternative
3. Woewodski Tap
4. Northern Alternative

The further evaluation of these four alternative routes is provided in the following sections of the report.

Transmission Line Design Concepts for the KPTL

System Voltage

For interconnecting the Petersburg electric system with Kake and/or the Woewodski Mine Site, three possible Intertie system voltage levels were examined: 24.9-kV, 69-V, and 138-kV, as well as a fourth blend of 138 kV/69 kV.

24.9-kV Intertie Concept

A 24.9 kV intertie is suitable for the light loading levels presently experienced by the Kake community. Two transformers are required, one connecting to the Petersburg electric system and the other at the new Kake Substation. The cost of submarine cables is lower for 24.9-kV than for the 69 or 138-kV concepts. We also found a need in this concept for a 24.9-kV voltage regulator and possibly a 1200 kvar load-side capacitor bank at the new Kake Substation. The disadvantage of this concept is that while suitable for present load levels, the voltage drop at 24.9-kV places low limits on the level of power that can be delivered to the Kake community under this concept in the future. The losses at 24.9-kV are roughly eight times what would be experienced using the 69-kV concept.

69-kV Intertie Concept

A 69-kV transmission line is attractive because the planned interconnection point in the Petersburg electric system is presently operating at 69-kV. Thus, only one 69 to 12.47-kV transformer located at the new Kake Substation would be required for this concept. In order to maximize the future supply capability to Kake, we also found a need for Load Tap Changer (LTC) controls on the new Kake transformer and possibly a future 2400 kVAr load-side capacitor bank, also at Kake. Compared to the 24.9-kV concept, the voltage drop experienced at 69-kV greatly improves the limits on the level of power that can be delivered to Kake. The losses are roughly an eighth of what would be experienced at 24.9-kV. A modest disadvantage is that the cost of 69-kV submarine cable is roughly 20 to 30 percent higher than for 24.9 kV cable.

138-kV Intertie Concept

A 138-kV transmission line is attractive because it permits the greatest delivery of power to the Kake community, though far in excess of anticipated needs. Losses are significantly reduced to about one-quarter of the losses expected at 69-kV. The most important advantage is that a 138-kV transmission line is more in keeping with the future operation of the Southeast Alaska Intertie Project. The existing Tyee-Wrangell-Petersburg (TWP) Intertie is constructed for 138-kV operation, though it is presently operated at 69-kV. Since the present TWP Intertie is operated at 69-kV this concept requires two 138-kV, 2500 kVA transformers: one 69-138 kV transformer near Petersburg, and a 138-12.47 kV transformer at Kake with a 12.47 kV voltage regulator. The major disadvantage of this concept is the much higher cost of 138-kV submarine cable as compared to 69-kV cable. At 138-kV and above, four single-phase cables are typically installed, as opposed to a single, 3-phase bundled cable for 69-kV and lower voltages. Although the unit cost of single phase cable is less than 3-phase bundled cable, the need to install four cables greatly increases the overall submarine cable cost for 138-kV, estimated to be in the range of 40% - 50% or more when compared to the cost of 69-kV.

138-kV/69-kV Intertie Concept

We have considered a 138-kV/69-kV concept where the transmission line is constructed with overhead transmission lines designed for 138-kV but operated at 69-kV, similar to the existing TWP Intertie. For the submarine crossings we would propose using 69-kV submarine cables in order to avoid the high cost of 138-kV submarine cable systems. When or if the KPTL is energized at 138-kV, the submarine crossings will be replaced with a 138 kV submarine cable system. Since present thinking is that this is not likely for at least another ten to twenty years, the 69-kV submarine cables are likely to be approaching the end of their expected life and potentially be nearing the time for their replacement.

Because operating the line at 69-kV is initially less costly and is more in keeping with the present and near-future needs of the Kake community, we prefer this concept to the previously described 138-kV transmission line concept. Other than a small increase in construction costs for the heavier 138-kV overhead construction this concept performs in a manner identical to the 69-kV Intertie concept.

Comparative Costs of Construction at Alternative Voltage Levels

The estimated cost to construct the KPTL at the various voltage levels previously described is shown in the following table.

TABLE 2-2
Kake - Petersburg Transmission Line
Comparative Cost of Overhead Transmission Line Construction at Alternative Voltages
(Dollars per Mile)

	Estimated Construction Cost Per Mile [1]			
	24.9-kV	34.5-kV	(*Preferred*) 69-kV	138-kV
Conductor Size				
4/0 (~ 212 kcmil)	$ 224,318	$ 224,318	$ 249,651	$ 306,369
266 kcmil	227,099	227,099	252,432	309,150
336 kcmil (*Preferred*)	246,651	246,651	271,984	328,702
Additional Cost For: [2]				
138-kV construction	$ 82,051	$ 82,051	$ 56,718	
138-kV insulation	-	-	12,844	
69-kV Insulation	$ 24,223	$ 24,223		

[1] Costs shown are for direct costs of overhead lines only and do not include submarine cables, substations or other system components. Includes the cost of fiber optic strands.

[2] Represents the additional cost necessary to construct the line to 138-kV but operate it at the indicated voltage.

Recommended Voltage

A detailed load flow analysis was conducted as part of this study to evaluate the impact of alternative operating voltages on overall system performance. The results of this load flow study are provided in Appendix A Based on the results of the load flow study, it is recommended that the KPTL be operated at 69-kV. While it is tempting to construct the overhead portions of the KPTL for future 138-kV operation in order to maintain consistency with other segments of the existing TWP system, the additional cost and lack of technical need causes us to recommend the KPTL be constructed to meet 69-kV construction standards.

The Tongass National Forest management prescriptions for Transportation and Utility Systems (Land use Designation TUS) would apply because the recommended 69-kV line would be defined as a major system, greater than the 66-kV minimum powerline voltage. Following the Tongass Land and Resource Management Plan (TLMP) will enable the utility system to be constructed and managed in a manner that is compatible with adjacent land use designations to the maximum extent feasible. Section 3 provides additional information regarding forest resource protection issues pertinent to this project.

Overhead Transmission Line Design Concepts

Conceptual Design

The conceptual design envisioned for the KPTL would use single wood pole, 69-kV structures with a vertical post insulator combined with horizontal post insulators. This design will be able to take advantage of existing roads for construction and maintenance and has been used successfully for other transmission applications elsewhere in Alaska. The average span length is estimated to be 350 to 400 feet. The only segments of the KPTL which are considered a candidate for H-frame long span construction are where no roads presently exist. The conductor considered is 336.4 kcmil 30/7 ACSR/AW “Oriole/AW”.

Structure Type

The 1996 Feasibility Study was based on using wood H-frame type structures for the 69/138 kV line. This H-Frame design concept was used successfully on the cross-country portion of the Ketchikan Swan Lake 115-kV line and has the advantage of allowing long span construction which can be used to advantage to avoid poor soil areas and for spanning large ravines. However, many 69-kV lines in Southeast Alaska have been constructed on single wood pole structures, particularly when the lines can follow existing roads.

The KPTL line route is not as rugged as Ketchikan’s Swan Lake line and the opportunity exists to follow logging roads for much of its length (the roadless section varies for the different alternatives but is estimated to be approximately 25% of the total line length). Following existing roads will provide access advantages during construction and will minimize the need for clearing. A short span road-side power line will also provide future maintenance advantages due to easy access and smaller structures. An example of the single wood pole design is shown in Figure 2-3.

Physical Loading

Typical physical loading criteria and associated overload capacity factors used for overhead transmission line designs in Southeast Alaska at lower elevations consist of combinations similar to the following criteria. Load cases 1 and 2 are required by the National Electrical Safety Code (NESC) for design of overhead utility lines. Load cases 3, 4 and 5 are based on local utility experience. Although these load cases sound quite severe they do not appear to significantly change the design outcome and do not have a significant cost penalty. For structure strength, this study has considered load cases 3, 4 and 5 in addition to the NESC required load cases for its feasibility assessment.

There have been reports of high ice loading in some locations along the alternative routes of the KPTL, particularly at the south end of Mitkof Island. During final design, a meteorological specialist may be consulted as to specific local ice conditions and whether or not certain sections of the line should be built to accommodate higher ice loadings. The length of any areas requiring higher strength construction than that contemplated for the majority of the KPTL is not expected to be extensive.

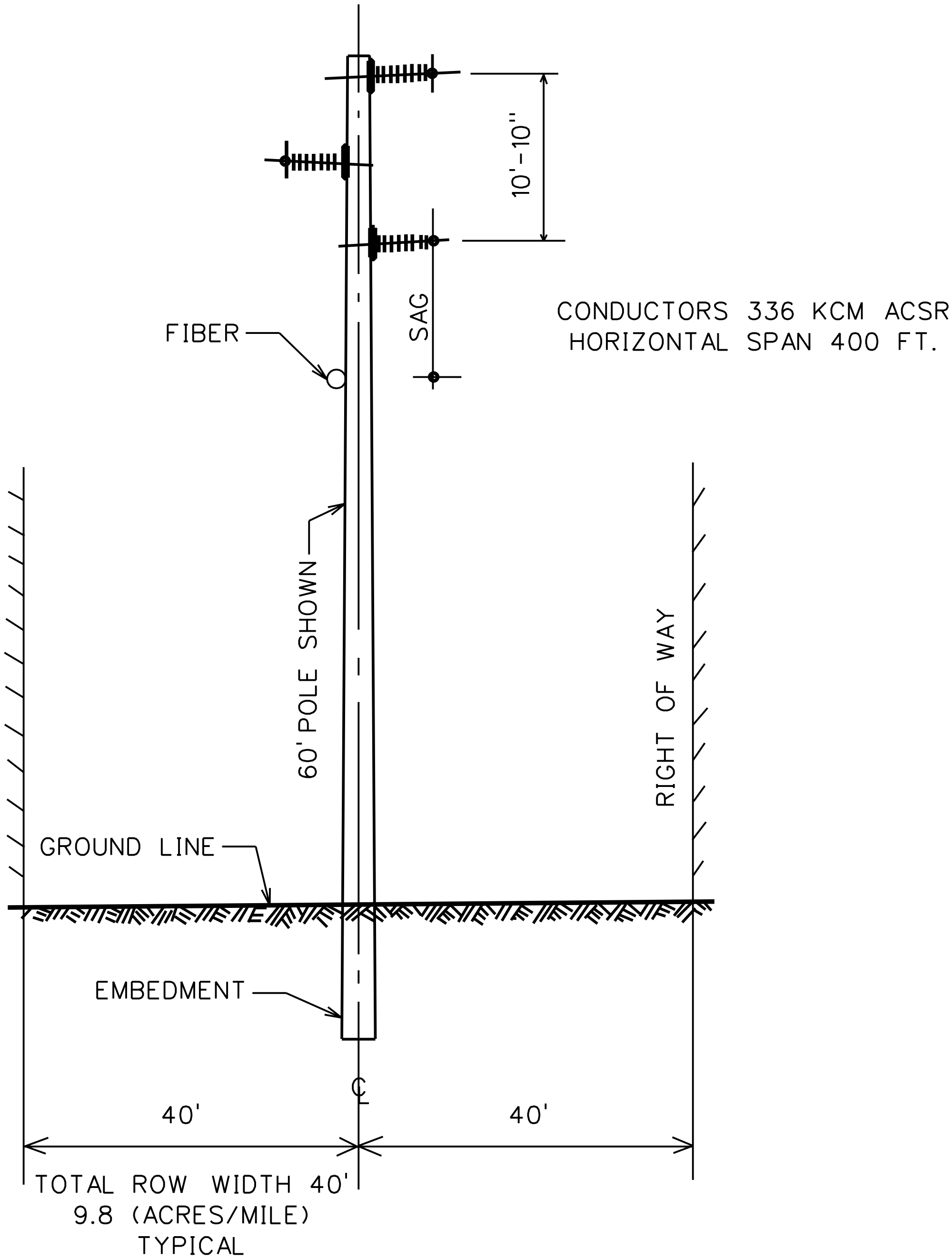


FIGURE 2-3

S.E. CONFERENCE
69KV WOOD POLE
TANGENT STRUCTURE

DRAWN	CHECKED	ENGINEER	PROJECT ENGINEER
JTR	*DKS*	*TSS*	*TSS*

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1. NESC Heavy - Method A.

   NESC Heavy loading consists of a 4 pounds per square foot (PSF) wind (40 MPH) applied to the structure and supported facilities with the conductors and cables coated by ½ inch radial ice which is assumed to weigh 57 pounds per cubic foot. For this case, conductor tensions are to be consistent with an ambient temperature of 0° Fahrenheit. Additionally, a constant of 0.3 pounds is to be added to the resultant of the wind and weight related loads (for the purpose of developing conductor design tensions only).

   Overload Factors which are applicable to the NESC Heavy Method A load case applied to wood structures are 2.5 for wind related loads, 1.5 for weight related loads and 1.65 for wire tension related loads. When using these Overload Factors for wood, a strength reduction factor of 0.65 is to be used. Guys shall use a strength reduction factor of 0.9. The applicable Shape Factor is 1.0 for cylindrically shaped components, 1.6 for components with flat sides.

2. NESC Extreme Wind

   For structures which exceed, or support facilities which exceed a height of 60 feet above ground or water level, an extreme wind condition is to be considered.

   NESC Extreme Wind loading for the Juneau/Hoonah region is generally considered to be 100 MPH nominal design 3-second gust (NESC Figure 250-2b). In accordance with the NESC, conductor tensions are to be consistent with an ambient temperature of 60° F. In Southeast Alaska the temperature criteria has typically been based on 40° F. Overload Factors that are applicable to the NESC Extreme Wind load case are 1.0 for wind, weight and tension related loads. For wood structures evaluated using these Overload Factors, a strength reduction factor of 0.75 is used. Guys are to utilize a strength reduction factor of 0.9. The applicable Shape Factor is 1.0 for cylindrically shaped components and 1.6 for components with flat sides.

3. Extreme Ice

   The NESC Extreme Ice case is based on 1.5 inches radial ice (57 pounds per cubic foot) at 30° F with no wind. This load case would be applied with a 1.0 Overload Capacity factor for wood structures for wind, weight and tension related loads while using a strength reduction factor of 0.75 for wood and 0.9 for guys.

4. Extreme Combination ice and Wind

   This load case is based on 1 inch radial ice (57 pounds per cubic foot) at 0° F in combination with a 4 PSF (40 mph) wind. This load case would be applied with a 1.0 Overload Capacity factor for wood structures for wind, weight and tension related loads while using a strength reduction factor for wood of 0.9 and 1.0 for guys.

5. Combination Snow and Wind

   This load case assumes 2 inches radial snow (37 pounds per foot) at 30° F in combination with a 2.3 PSF (30 mph) wind. This load case would be applied with a 1.0 Overload Capacity factor for wood structures for wind, weight and tension related loads while using a strength reduction factor for wood of 0.75 and 0.9 for guys.

Foundations and Structure Support

The soils in Southeast Alaska vary from muskeg to rock and everything in between. Earlier field work has indicated that much of the Center – South route of the KPTL is glacial till and colluvial, acceptable for standard direct embedment foundations. The 1987 Intertie Study was based on cross-country construction and the report estimated the mix of soils at 75/15/10 percent for normal, rock and muskeg soils, respectively. However, even in the areas considered normal the top 3 feet to 5 feet of material is organic and has essentially no lateral strength capability.

The preliminary design for the KPTL as defined in this study is based on standard embedment depths plus an additional 4 feet (10% of pole length + 4 feet) for tangent structures in normal soils. Structures located in rock and guyed structures are assumed to be embedded at standard embedment depths (10% + 2 feet). Pole structures located in muskeg can be stabilized using a wood raft at ground line with side guys or by construction of a foundation system using either driven H-piles or by using a culvert embedded at a depth required for lateral stability and the pole placed inside the culvert.

It is anticipated that with short-span construction generally following the roads that the KPTL will follow, the mix of soils will be about the same as suggested in the 1987 Intertie Study report, 75/15/10 percent for normal, rock and muskeg soils.

Most sites will require imported granular backfill hauled to the site. Poles that are located off the road by more than 20 feet will require an access work pad created by extending the road fill to the site. Where the distance from the road makes this impractical, temporary lagging would be used to gain access to the site during construction. If the distance is extreme, helicopter access would be considered. In the roadless sections near Duncan Canal, it is assumed a staging area would be constructed and access to structure sites would be by helicopter.

A diagram of the typical pole embedment is shown in Figure 2-4.

Electrical Clearances to Grade

Minimum clearances above grade for conductors are required by the NESC based on line voltage and land use under the line. The NESC required clearance must be maintained under either of two conditions: 1) the conductor sagging at its maximum operating temperature (120° F minimum), and 2) under the NESC Heavy loading district requirement of ½ inch radial ice at 30° F (without the 4 psf wind). The vertical clearance for 69-kV lines above roads and lands that can be traversed by trucks is 20.2 feet.

Engineering judgment should be used to determine if clearances in addition to the minimum required by NESC should be applied. This would apply to any specific area that may have access to unusually large vehicles or special conditions such as extreme snow depths. In addition to the basic clearance requirement, it is generally prudent to add a plotting margin (2 to 4 feet) to compensate for irregular terrain not identified in the survey, side hills, plotting errors, construction variables and other contingencies. For the purpose of the preliminary layout, the basic ground clearance has been assumed to be 25 feet minimum with the conductor temperature at 120° F final sag.

Conductor Selection

For this analysis three conductor sizes have been considered: 336, 266, and 4/0 Aluminum Cable Steel Reinforced (ACSR) conductors. All three conductor sizes are adequate for carrying the 7,000 kilovolt-amperes (kVA) ultimate voltage limited capability of the 69-kV transmission circuit to Kake. Using Westinghouse transmission and distribution ratings as a conservative normal system rating, these conductors are capable of 530, 460, or 340 Amps, respectively. Assuming an ultimate load of 60 amps (7000 kVA at 69-kV) even the 4/0 ACSR conductor is loaded to less than 20 percent of its capacity.

Even with these light loadings, the stronger 336 ACSR conductor would be preferred for this project. The existing TWP transmission line uses 336 ACSR conductor and, therefore, the two systems can share a common stock of spare conductor if 336 ACSR conductor is used for the KPTL. Further, the terrain traversed by the KPTL is rough and much of it will be difficult to reach for timely maintenance. The additional mechanical strength of the 336 ACSR conductor should reduce the amount of maintenance required over the life of the KPTL. A third point is that if the full plan for the Southeast Alaska Intertie Project is completed, the Sitka – Kake transmission interconnection may require the additional capacity of the 336 ACSR conductor.

Based on the recommended operating voltage of 69-kV, it is further recommended that the KPTL be constructed with 336 kcmil ACSR conductor. The additional cost of 336 ACSR, as compared to the smaller conductor options evaluated, is not estimated to be significant.

The conductor suggested by earlier studies and used for this study is a 336 kcmil 30/7 ACSR/AW (Oriole/AW). Sag/tension charts were developed for this conductor based on the following tension limit criteria:

- 15% Ultimate Rated Strength at -5° F initial
- 20% Ultimate Rated Strength at -5° F Final
- 50% Ultimate Rated Strength at NESC Heavy Loading Initial
- 75% Ultimate Rated Strength at Extreme ice (1.5 inch) Loading Initial
- 75% Ultimate Rated Strength at Extreme snow (2 inch) Loading Initial

Right-of-Way Clearance

Right-of-way width is often established based on conductor blowout. However, essentially the entire line length of the KPTL is undeveloped and therefore blowout of the conductor is not a consideration. Clearing and maintaining of the right-of-way will be a major cost item during initial construction and for future maintenance. This issue requires a compromise between the initial cost of removing danger trees and the amount of maintenance that will be required on an annual basis and following extreme weather conditions.

Reliability of the line will be of major concern to IPEC, KWETICO and the FDPPA. The line will be designed to withstand anticipated extreme weather conditions, however, it will not be designed to withstand the impact of falling trees. In the areas where tall trees exist, reliability of the line is directly related to the extent of clearing. From strictly a reliability standpoint any tree that could potentially strike the line when falling should be removed. Based on the fact that some line sections will be located in areas where there are 100′ to 150′ tall trees, the width of clearing would calculate to be upwards of 300 feet depending on the selected route. A narrower right-of-way requirement will be acceptable in other areas.

Where the line is placed near roads the road itself will provide approximately 50′ of cleared width on the roadside. Also, much of the area along the route of the KPTL has been clear-cut in the recent past. Areas that have been clear-cut, even as long as 35 years ago, have much shorter trees, often less that 40 feet in height. Fast growing scrub trees such as alder may require clearing within the right-of-way along existing roads. Typical pole placement and clearing requirements along existing logging roads are shown in Figure 2-4.

Based on an objective of minimizing future maintenance costs suggested clearing criteria for the KPTL would be to:

- Cut all trees within 50′ from centerline. Low growing brush would not be cut.
- Cut all brush in the immediate vicinity of structures.
- Remove all trees that could strike the line if they fall.

Access Road Construction Standards

It is proposed that where existing logging roads do not exist, an access road be constructed alongside the entire KPTL route, except in the Wilderness Area where a narrower, less intrusive access trail is to be constructed. The access road will be built as a modified logging road with a 60 foot-wide right-of-way, a total 14 foot-wide road with a 10-12 foot-wide gravel covered surface and a road bedding made with typar or filter fabric. The USFS typically uses a 60 foot wide right of way for its standard log haul road but prepares a slightly larger road surface.

Logging roads are built differently than Alaska Department of Transportation (ADOT) arterials and collector roads. In areas of muskeg, the logging roads are typically built on top of the significant layer of organic material. In this manner, the road “floats” on the muskeg underlayment and continues to settle over time. The ADOT removes the muskeg underlayment before building its roads. In areas of Southeast Alaska where the ADOT is building new

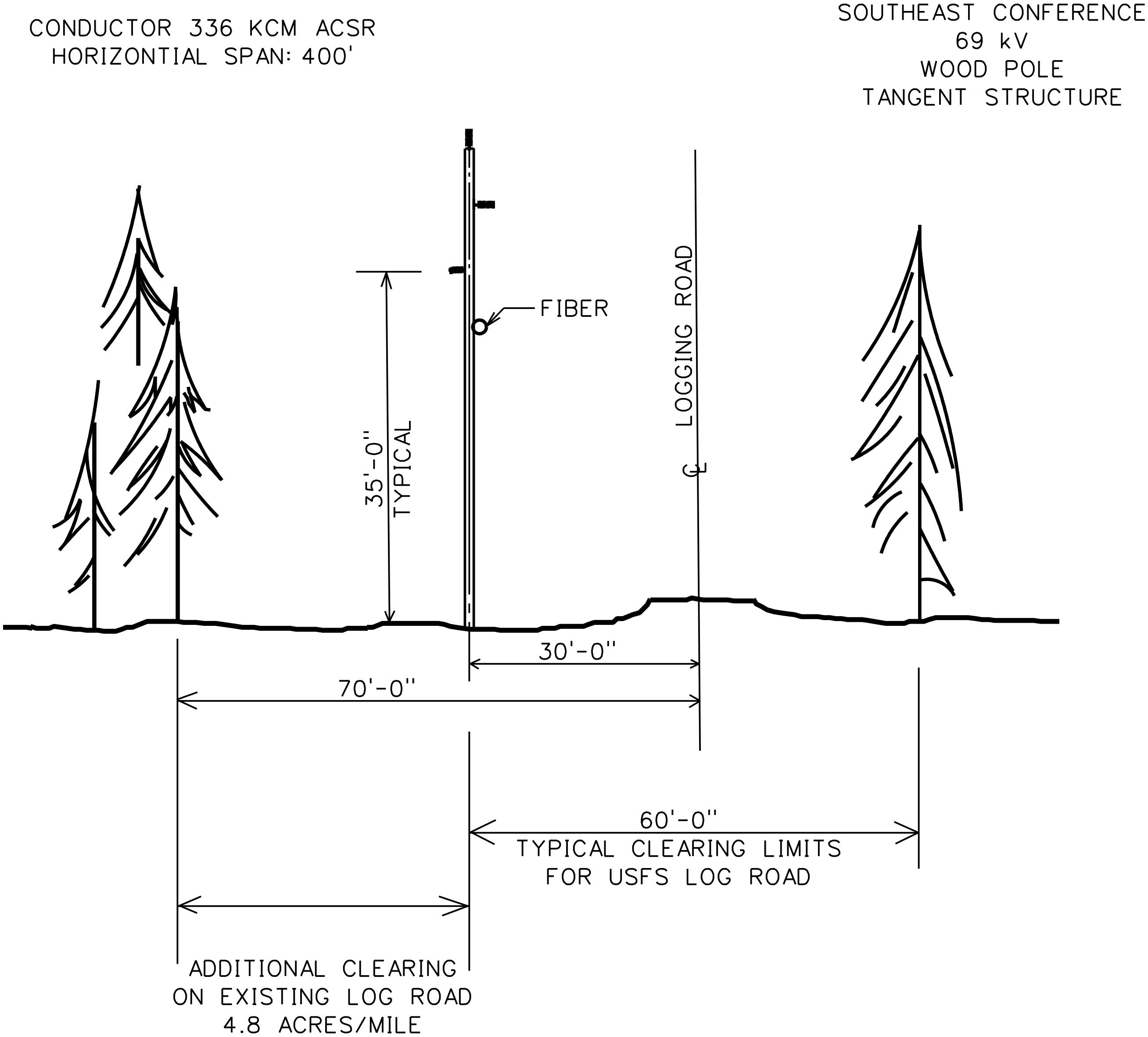

FIGURE 2-4

DATE: 05/05

DRAWN	CHECKED	ENGINEER	PROJECT ENGINEER
JTR	*DKS*	*TSS*	*TSS*

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JACKSON, MICHIGAN   LA CONNER, WASHINGTON collector roads and arterials on existing log haul roads, such as on Prince of Wales Island, the cost of the road construction is indicated by ADOT to be nearly as high as new construction because of the need to remove the organic underlayment along so much of the route.

The typical ADOT standard for an island collector road is a 22 foot-wide, paved road surface with a 2 foot wide shoulder. An island arterial road is a 22 foot-wide paved road surface with a 7 foot-wide shoulder. The posted speed on the collector road is 30 mph while it is 35 mph on the arterial[5].

Raptor (Eagle) Protection

Southeast Alaska is home to many eagles and therefore the line design must consider raptor (eagle) protection. The electrical industry standard for raptor protection is currently based on "Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996". This publication suggests that 60 inches between conductor phases as well as 60 inches to all grounded parts will provide a safe design for large raptors such as eagles. The conductor phase spacing of most 69-kV lines exceeds this recommended dimension.

The distance from conductor to ground needs to be considered, however. A potential problem could exist in that the typical 69-kV insulator is only 36″ to 42″ in length and therefore, if the base of the insulator is grounded, a conductor to ground path would exist that does not meet this standard. The design considered in this report assumes that an overhead ground wire will not be required and line hardware will not be grounded or bonded.

The 69-kV single pole design absent the ground wire meets the spirit of the raptor protection guidelines. It is also important to note that this design has been used by AEL&P at other locations without problems related to raptor fatalities. Historical performance is considered to have more significance, in this case, than the published guidelines.

Substation Concepts

For all of the routes described below that start from "Center," it is proposed that a new switching station be constructed at node T that will tap into the existing TWP 138-kV/69-kV transmission line. For this report, this substation is designated as substation Sub-T, the location of which is shown in Enlargement A of Figure 2-7. At Kake, a substation facility to connect to IPEC's existing 12.47-kV distribution system will need to be constructed. It is recommend that these new facilities be configured as shown in Figure 2-5.

To ensure continued system reliability for the existing Petersburg electrical system, a breaker for the Kake exit at Sub-T is recommended. Circuit problems on the new KPTL will then only affect the Kake load. Similarly, a second breaker is proposed for the Petersburg exit at Sub-T such that circuit problems north towards Petersburg will be isolated from affecting the Kake load. For initial Sub-T exit to Wrangell a motor-operated disconnect switch is recommended.

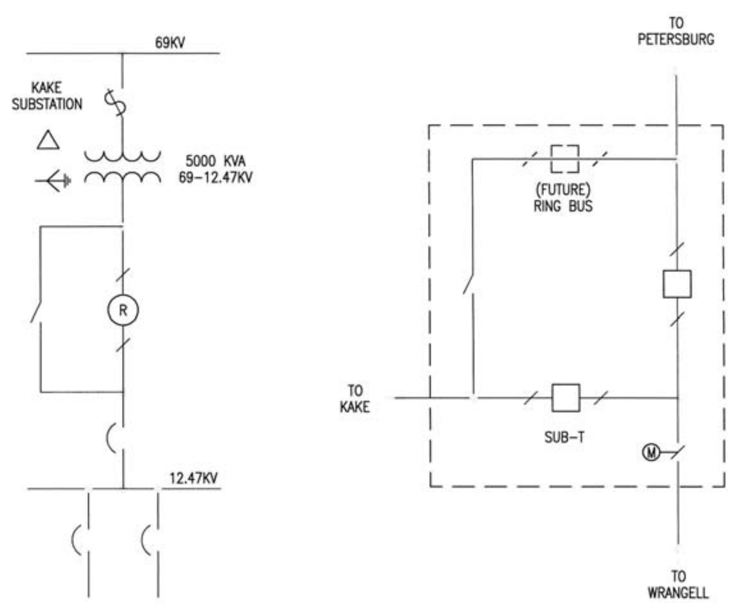
[5] Source: Southeast Alaska Transportation Plan dated September 2004, Figure A-1.

Initially, without special foreknowledge, the unplanned loss of the interconnection to Wrangell will cause an outage for both Petersburg and Kake with or without a third breaker at Sub-T. Therefore, it is not prudent to add the expense of a third breaker at this time. However, if the Sitka – Kake Intertie is built at a later date, Sub-T should be expanded into a three-breaker ring bus. With two independent sources of supply one will suffice if the other is lost so the added reliability of a full ring bus at Sub-T becomes prudent. Designing the new Sub-T for future expansion into a three breaker ring bus is a nearly zero cost plan to minimize the future costs for when, or if the Sitka – Kake Intertie or another similar development is built.

The new Kake Substation is proposed to be configured as a single distribution transformer with a primary fused disconnect, a distribution class plus or minus 10 percent voltage regulator, and two 12.47-kV exits. IPEC's generating units will be interconnected with the TWP system but will not generally be used at the same time that power is being delivered from Lake Tyee. The Kake substation is expected to be constructed at a suitable site near Kake but not necessarily at the site of the powerhouse. The substation will serve as the termination of the KPTL. The substation is expected to include breakers, a disconnect switch and a 69/12.47-kV transformer to interconnect with the IPEC distribution system in Kake.

Submarine cable termination yards will be needed on both ends of each cable crossing. The submarine cable termination yards are expected to require relatively small areas that will serve as the interface between overhead sections of the line and submarine cables. They will generally be located near the shoreline but behind existing treelines to limit visibility from the water. The termination yards will contain lightning arrestors and risers that connect the overhead system to the submarine cable. Disconnect switches would also be installed to allow for the electrical isolation of the cable for maintenance and testing.

FIGURE 2-5
Proposed Configuration of the Kake Substation and the TWP Interconnection Facility



Submarine Cables

All of the route alternatives will require submarine cable crossings of marine waterways. Cables to be used for the KPTL submarine crossings would be similar to the crossing between Douglas Island and Young Bay that will be installed during the summer of 2005. The cable would be a single-armored, 69-kV, 3-phase, 4/0 conductor, dielectric submarine cable with bundled fiber optic communication lines. The bundled cable will be about 6 inches in diameter, however, the exact cable specification will not be known until final design is complete. A cross section diagram of the submarine cable being used on the Juneau-Greens Creek transmission line currently under construction is shown in Figure 2-6.

An important factor in specifying the submarine cable will be the determination of potential extensions of the KPTL to Sitka or other load centers beyond Kake. The Wrangell Narrows crossing will need to accommodate the load associated with the potential mining facility on Woewodski Island. For the Center-South Alternative, it is expected that both the Wrangell Narrows and the Duncan Canal crossings would be placed at essentially the same time with the same cable laying equipment. This should reduce the mobilization costs which are quite significant.

Two separate submarine cable crossings will be needed for the Center-South Alternative. The first, crosses Wrangell Narrows about eight miles south of downtown Petersburg and is about 0.6 miles in length. Tide movements are indicated to be very limited at this location and the waters are generally calm. The second crossing is about 1.2 miles in length and crosses Duncan Canal between points about 1.75 miles south of the mouth of Mitchell Slough on the east and about 2.5 miles south of Indian Point on the west side of Duncan Canal.

From NOAA charts the water depth at the Wrangell Narrows crossing appears to increase uniformly from 0 feet at the shoreline to 110 feet near the center of Wrangell Narrows. The nautical charts show a bottom that consists of mud and rocks. No evidence of steep terrain or large rocks, that might cause suspensions in the submarine cables, has been detected. However, a thorough submarine topographical survey and subsurface profile needs to be accomplished to determine the best route for the submarine cable. This will identify areas to be avoided such as shipwrecks, large rocks, rock outcroppings, etc., that could cause suspensions and damage to the cable. This survey may be conducted utilizing a multi-beam sonar system such as the Reson Seabat 8101. If deleterious conditions are suspected, additional information should be obtained with a side-scan sonar system.

Based on the information presently available, no obvious problems are anticipated with the cable installation at Wrangell Narrows. The cable should be buried approximately 1 meter in depth at both shores, out to a depth of 10 feet below Mean Lower Low Water (MLLW). Either direct burial or placement in a duct with a thermal backfill may be utilized. Due to the large amount of boat traffic through Wrangell Narrows, burial for the entire length is recommended.

The water depth at the location of the Duncan Canal crossing is approximately 100 feet at maximum. No particular problems are anticipated with this crossing except that the timing of placing the cable should be coordinated so as not to interfere with the crabbing season in the Canal.

Both of these submarine crossings were surveyed as part of the 1987 Intertie Study[6]. Findings related to these surveys are:

> "The crossing on Plate 5 [Wrangell Narrows] is a bowl-shaped depression as deep as 110 feet. Most of the alignment is soft bottomed except the eastern approach to Mitkof Island. Slopes on the east approach vary between 10:1 (6°) and 2:1 (27°) whereas those in the west approaching the Lindenberg Peninsula of Kupreanof Island are more gentle, varying between 14:1 (4°) and 3:1 (18°). There do not appear to be any obstacles to construction at this crossing. Wrangell Narrows is a busy thoroughfare for ship traffic, both commercial and recreational. Tanner crab fishing occurs from mid-January to mid-February and salmon trolling lasts from May through the first week in June."

> "Crossing 6.5 [Duncan Canal], Plate 6, is bowl-shaped in cross section with a fairly gentle west approach to Kupreanof Island, 11:1 (5°), and a steeper approach to the Lindenberg Peninsula, 6:1 (9°). Echograms indicate the crossing is probably floored by soft sediments and its deepest point is approximately 100 feet. The very near shore parts of the approach sounded with lead line may be hard bottom. There are no submarine cables in Duncan Canal. Construction in Duncan Canal may be delayed if emplacement is planned during the commercial crab fishing season. Dungeness crab fishing season is split with a summer season from May through September, and a winter season from October through January."

Fiber Optic Communication Cable

It is expected that a 24 strand fiber optic communication cable will be included in the KPTL design. Initially, the fiber optic system will be used for control of the KPTL system. For the overhead portions of the line, the fiber strands will be bundled within an aerial cable. For the submarine crossings, the fiber-strands will be an integral part of the bundled cable design. The terminations of the fiber optic cable will need to be connected to local communication systems at a later date. The termination and interconnection facilities have not been included in the preliminary design included in this study.

The engineering consideration for the transmission design of the overhead fiber optic cable was divided into three principal categories, system planning, electrical design of system components, and the mechanical design of the line. For the purposes of the KPTL preliminary design, ALCOA "ADSS" 24 strand aerial cable has been selected. A 24 strand fiber cable is more than sufficient to meet the communication needs of control and data collection of the system operation. In addition extra fiber would be available for commercial and system voice communication. There is a very slight difference between 12 and 24 strand fiber. We

[6] Crossings 6.1 and 6.5, Appendix A, Transmission Line Submarine Crossings – Oceanography/Meteorology, Alaska Power Authority, Southeast Alaska Transmission Intertie Study, Harza Engineering Company, October 1987. Note that the eastern landing of the Wrangell Narrows crossing as surveyed for the 1987 study appears to be slightly north of the presently defined location.

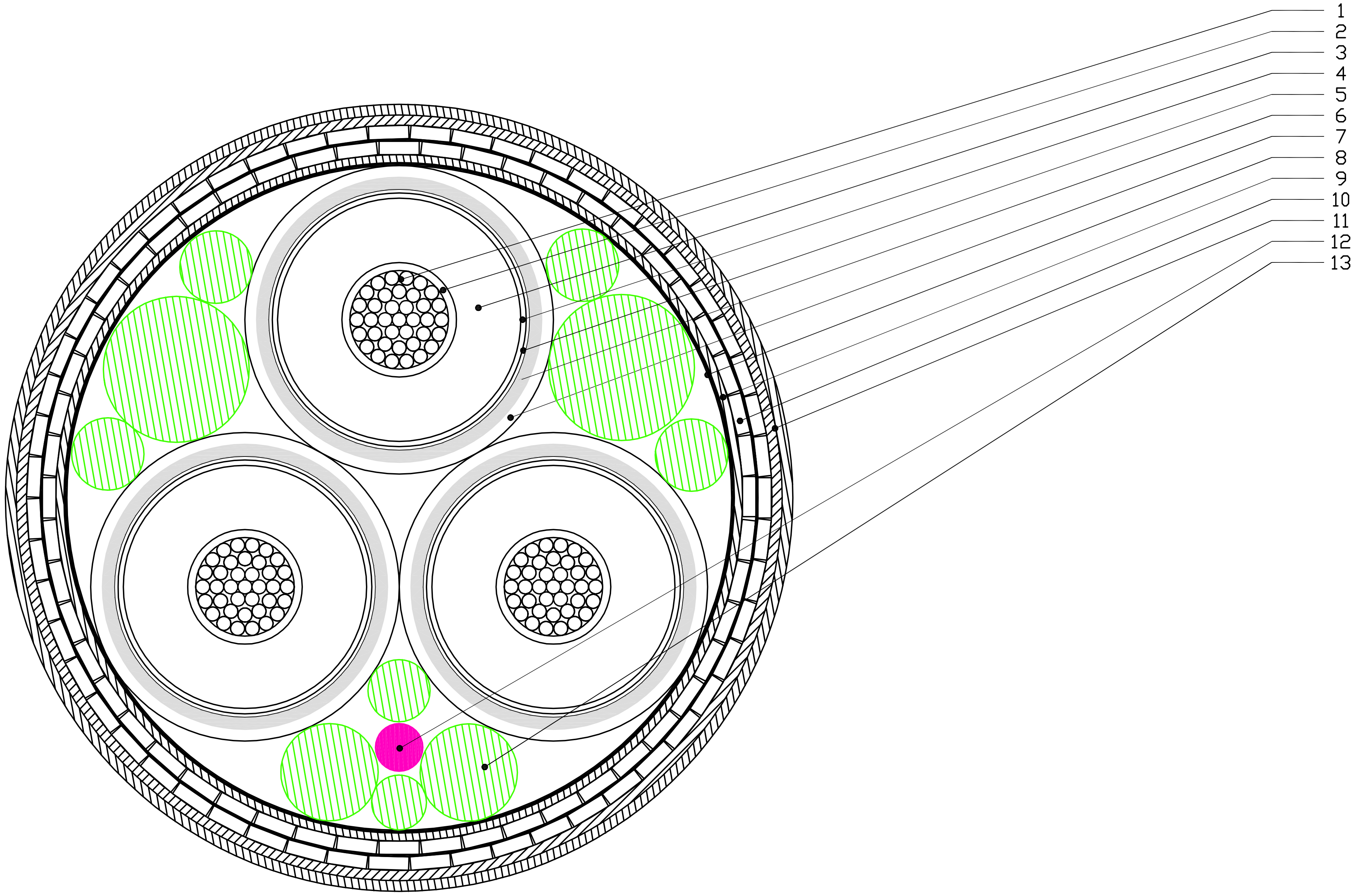


FIGURE 2-6

CABLE WEIGHT, IN AIR	29 lbs/ft	43 kg/m
CABLE WEIGHT, FLOODED	20 lbs/ft	30 kg/m

NO	CONSTITUENTS	NOMINAL THICKNESS	APPROX DIA.
1	CONDUCTOR, STRANDED COPPER WIRES WITH WATERBLOCKING COMPOUND	–	0.72" [18.4 mm]
2	SEMI–CONDUCTING COMPOUND	60 mils [1.5 mm]	
3	INSULATION, XLPE	472 mils [12.0 mm]	1.79" [45.4 mm]
4	SEMI–CONDUCTING COMPOUND	40 mils [1.0 mm]	
5	SEMI–CONDUCTING WATER–SWELLABLE TAPE	28 mils [0.7 mm]	
6	LEAD SHEATH	83 mils [2.1 mm]	2.09" [53.2 mm]
7	SEMI–CONDUCTING PE SHEATH	79 mils [2.0 mm]	
8	BINDER TAPE, NYLON	2x7.9 mils [2x0.2 mm]	
9	BEDDING (PP–YARNS)	60 mils [1.5 mm]	
10	ARMOUR, TWO LAYERS OF GALVANIZED STEEL WIRES	Approx. 50/53, 295x98 mils [7.5x2.5mm]	
11	PP–YARNS AND BITUMEN, TWO LAYERS	2x79 mils [2x2.0 mm]	5.79" [147 mm]
12	FO–CABLE (48 SM FIBRES) WITH SEMI–CONDUCTING OUTER SHEATH	ø394 mils [10 mm]	
13	POLYPROPYLENE YARN FILLERS	–	

ISSUE	DATE	REASON FOR ISSUE	DRAWN. BY	PREPARED	CHECKED	APPROVED		REVISION
E1	160305	Issued for Construction	VSL	VSL	HNB	RuR		
R1	230205	Issued for Review	VSL	VSL	HNB	RuR		
D1	220205	Issued for IDC	VSL	VSL	HNB	–		

SCALE 1:1 FRAME : A3 PROJECTION

NEXANS NORWAY AS | CLIENT

CLIENT:
Kwaan Electric Transmission Intertie Cooperative
Juneau/Greens Creek/Hoonah Intertie
"Segment 1"

CLIENT'S DRAWING NO.:

CONTRACT NO.: EB05502

DOCUMENT CATEGORY:

DRAWING TITLE:
CROSS SECTION DRAWING
TKVA 69kV 3x1x240mm2 KQ + FO

NEXANS DRAWING NO.: 22272–HTA–XC–201365

SHEET 1/1

recommend at the time of construction the volume of traffic and system needs be re-evaluated. The transmission structures are sized to support the 24 strand ADSS.

Space has been allocated in the preliminary design of the KPTL structures to install fiber optic ADSS cable. Sag and tension is to be obtained from cable manufactures in the form of computer hardware and software programs. The cable manufacturers will usually prepare such data and provide consultation concerning the design data parameters for the project. It is our recommendation that the fiber optic cable installation meet Heavy Loading and Grade B construction.

ADSS cables tend to vibrate at higher levels than other cables of comparable size, due to their lighter weight. Also the “soft” nature of their jackets and internal construction requires special consideration. A special damper, called the Dielectric Damper, has been developed specifically for application on ADSS cables which should be installed for span lengths as follows:

- 228 ft – 600 ft; quantity – 2; placement – one on each side of pole
- 601 ft – 1200 ft; quantity – 4; placement - two on each side of pole

The mechanical strength requirements of an overhead line supporting structure are determined with the structure in an overloaded condition. The basic external design loads supported by the structure are multiplied by design overload capacity factors to obtain the value of the forces used in determining the required strength of the structure and structure components. The external loads supported by the structure consist of the wind on the exposed surfaces of the structure and the resultant tension of each cable span attached to the structure. These loads continually vary and are functions of the weather, initial stringing tensions placed in the cables, and status of permanent stretch in the cables. It is necessary to identify the specific conditions of loading for which the structures are designed and the specific values of overload capacity factors, which are applied.

ALCOA Sag10 Version 3 is recommended to formulate sag tables for installation and investigation of final sag clearances. In order to initiate sag information into the software program, Cable diameter, weight, rated breaking strength (RTS), maximum rated tensile strength (MRCL), thermal coefficient of expansion and moduli for initial, 10-year creep and final conditions are required form manufactures of the ADSS Cable. For the purposes of this study we have selected the ALCOA product.

Power Flow Analysis

As part of the KPTL Study, a power flow analysis was conducted to evaluate several factors with regard to the operation of the KPTL. The power flow analysis developed computer models of the interconnected electric systems to identify the desired system configuration, recommended system enhancements, and identify special provisions that might be needed for reliable and economic system operation. The analysis evaluated the interconnected system with and without the inclusion of a mining facility on Woewodski Island. A system modeling database was obtained that includes available generation resources, existing transmission facilities, and each proposed alternative transmission route’s electrical characteristics.

An important element of the power flow analysis was the determination of the recommended KPTL voltage and the recommended conductor size. The analysis also defined the substation improvements needed in Kake and the switchyard facility that will be needed at the interconnection of the KPTL with the existing TWP transmission line near Petersburg.

The following planning criteria was used in the analysis:

- Under normal system conditions, voltages at load serving facilities should range from a maximum of 105 percent of nominal system voltage to a minimum of 95 percent.
- Maximum voltages for the Intertie transmission buses should not exceed 110 percent of nominal system voltage during energization procedures when no load is being served.
- Minimum voltages may sag to as little as 85 percent of nominal as long as there is no danger of voltage collapse for the non-load serving intertie transmission buses under heavy system load conditions.
- Facility loading should not exceed 100 percent of normal system seasonal ratings as specified by the manufacturers of the submarine cables, or for overhead transmission system, as determined based on standard conductor loadability.

The power flow analysis concluded that facilities are limited by voltage constraints and not by thermal limitations of transmission line loadability for the presently planned. The analysis also recommended that the KPTL be operated at 69-kV using 336 kcmil ACSR conductors. The analysis, conducted by Commonwealth Associates, Inc., is provided in Appendix A to this report.

Detailed Route Evaluation

A number of US Forest Service roads have been built in the area where the KPTL would most likely be located. These roads will facilitate construction and maintenance of the line by providing ground access to the area. In more remote regions, construction crews and materials are usually transported by helicopter which contributes to higher overall construction costs. An alternative approach for constructing the KPTL in areas where roads do not presently exist, would be to construct an access road along the transmission line. An access road would typically be of a slightly lower quality than the existing USFS roads in the area.

As previously indicated, a number of previous studies have been conducted to evaluate potential route alternatives for the KPTL. The 2003 Intertie Study relied extensively upon the results of previous studies, incorporating newer information and updating previous cost estimates primarily using various cost escalation factors. The 1996 Feasibility Study was intended to define the design and routing criteria, estimate costs, provide a brief environmental review and assess the economic and financial feasibility of an Intertie between Petersburg and Kake. It was based on a 3-phase AC overhead system with submarine crossings of major water bodies. The 1996 Feasibility Study included a review and summary of the earlier reports and included consideration of the Kake Coastal Management Program, Public Hearing Draft dated April 1984.

The 1996 Feasibility Study did not include any field work or visits to the project area and relied solely on work from previous studies tempered with consultation and input from local utility, and various State, federal and local governmental agency personnel. Earlier reports which included site reviews were the 1984 Ebasco[7] and 1987 Intertie Study reports. The 1984 Ebasco study included fairly extensive field work and analysis of construction conditions for a Petersburg to Kake Intertie and included a number of drawings highlighting features along suggested routes. The 1984 Ebasco report provides a reasonable description of the terrain and soils along the preferred Southern route.

Changes have occurred since the 1984 Ebasco report relative to the number of logging roads and the amount of logging and clearing that would be required along the route. The 1984 Ebasco report suggested a floating camp in the Duncan Canal area with material hauling using helicopters in the roadless section of the route, a distance at the time of approximately 20.5 miles. The roadless section of the route identified in the 1984 Ebasco report, which is essentially the same as the current Center – South Alternative, has now been reduced to approximately 13 miles.

The 1987 Intertie Study report included bathymetric surveys of the proposed submarine cable crossings and included a compilation of public and agency comments received at the time of the 1987 Intertie Study.

All of the earlier studies concluded that the southern route was preferred, absent detailed environmental analysis. The 1996 Feasibility Study, which considered two routes along the currently defined routes of the Northern Alternative and the Center-South Alternative, concluded: "…the southern route is preferred based on public comment, agency comment, previous study findings, and engineering and environmental judgment." All of the earlier reports emphasized the need to conduct environmental studies prior to selection of a specific route.

KPTL Alternative Route Descriptions

As indicated previously in this report, the ten initially considered route options were reduced to the following four options:

1. Center – North Alternative (Wilderness Route)
2. Center – South Alternative
3. Woewodski Tap
4. Northern Alternative

A map showing these route alternatives is provided as Figure 2-7. Reference to this map and the Node points (e.g. T, T1, S3, K) shown on it should be made to better understand the route descriptions which follow.

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[7] *Tyee-Kake Intertie Project, Detailed Feasibility Analysis, Volumes I and II*, prepared for the Alaska Power Authority by Ebasco, Inc., 1984.

Center-North Alternative (Wilderness Route)

Photo 1 – Looking west across Wrangell Narrows towards the log transfer facility.

The proposed route of the Center-North Alternative begins at a tap of the 69-kV TWP transmission system at a point approximately eight miles south of Petersburg. The route crosses Wrangell Narrows, traverses west and north on the Lindenberg Peninsula to a point just south of Portage Bay and then proceeds west to Kake. A significant feature of this route alternative is that approximately nine miles passes through the western edge of the Petersburg Creek – Duncan Salt Chuck Wilderness. The Center-North Alternative has a total length of 59.0 miles of which 41 miles is along existing USFS roads. A single 0.6 mile long underwater crossing of Wrangell Narrows is included in this alternative.

The route starts at the "Petersburg Tap" of the existing TWP line at Node T, which is located about 4,800 feet from the water at this point. An overhead line will be constructed from Node T that crosses the highway and then parallels the highway to a point near the former Alaska Experimental Fur Farm. The line would then proceed west from the highway to a point near the water where the overhead line would connect to the submarine cable that crosses Wrangell Narrows. A relatively narrow, 60 foot right-of-way could work in this area although a 100 foot right-of-way would be desired. Land ownership at this location is either State or USFS.

At this point, Node T1, a relatively simple submarine cable termination structure would be constructed where the bundled, 3-phase submarine cable and fiber optic cable is connected to the overhead line. The submarine cable will leave the structure through an 8 inch diameter schedule 80 PVC duct that will be placed in a trench that reaches the mean low water (MLW) line. From there, the cable would be placed in a split duct casing and buried in a trench to a point where the water depth is about 100 feet.[8] The location of the cable across Wrangell Narrows is out of the commercial shell fishing area and the area normally dredged. A warning sign onshore on both ends of the cable will alert marine traffic to a buried power cable. Wrangell Narrows is a very active marine environment where pleasure and commercial vessels travel year around. It is also a fly path for both commercial and pleasure aircraft.

[8] Due to the high level of marine traffic in Wrangell Narrows and the relatively shallow crossing depth, it may be preferable to bury the submarine cable along its entire length. This would greatly reduce the potential damage to the cable from ship anchors and other

The submarine cable will exit the west side of Wrangell Narrows in a similar fashion and connect to an overhead line at Node T2. This will be at a point near the existing Tonka log handling facility. A submarine cable termination structure, comprised of lightning arresters and a steel-pole riser for the overhead-to-underground transition, will be constructed near the shoreline but sufficiently inland to limit its visibility from the water and to stay above the tidal zone. Between Nodes T2 and T3, a distance of about 1.5 miles, the line will be located just off the existing logging roads in a heavily forested area. Right-of-way clearing will be needed in this area. Between Nodes T3 and T4, approximately 1.8 miles of the route is in a forested area requiring right-of-way clearing and 6.2 miles is in a muskeg area that will probably only need minimal brush clearing. Between Nodes T4, T10 and T5, the route passes mostly through heavily forested areas with part of the existing USFS road on a steep hillside. Clearing will be needed on the uphill side of the road in this area. The entire length of the route between Nodes T2 and T10 is adjacent to existing USFS logging roads.

Photo 2 – Looking north up Duncan Canal toward Wilderness Area. Existing logging road is in foreground. Location of Node T10 is in center of picture.

The route between Nodes T5 and S3 is primarily located in the Wilderness area. From aerial reconnaissance it appears that an old trail exists near where the line is proposed to be placed. It is proposed that the right-of-way be cleared to a minimum width of 60 feet and a maintenance trail would be built along side the line. Through this section of the route, the ground is generally level and the forest cover is relatively light. Approximately 4.7 miles of the route between Nodes T5 and S3 is located in forested area and 6.7 miles is in muskeg area, none of which is along existing USFS roads.

At Node S3, the route of the Center-North Alternative is the same as the Northern Alternative. Between Nodes S3 and S4, approximately 4.0 miles of the total segment length of 9.7 miles will be along existing USFS roads. It is proposed that an access road be built along the 5.7 miles of the route where currently there is no road. Relatively easy access to clear and build roads will be available along this section of the route. During the field reconnaissance the depth of the muskeg was measured at between four and six feet at a point approximately three miles east of Node S4. Between Nodes S4 and S5, the entire segment length of 12.2 miles will be alongside existing USFS roads. Clearing requirements along this segment will be limited to only 2.0 miles through forested areas. Access to this segment of the route will be good from Kake.

The 10.2 mile long segment between Nodes S5 and K (Node K is the termination of the route at the substation in Kake) will be entirely along existing USFS roads. Some clearing will be needed along 7.2 miles of the segment length although much of this area has been previously logged and only scrub trees exist. Several locations would be suitable to place a new substation in Kake although enough level ground is not readily available at the site of the existing powerplant. The substation could be located just north and west of the airport runway. Access to IPEC's distribution circuits would be relatively straightforward from this location.

Center - South Alternative (Old "South" or "Tonka-Duncan Canal" Route)

The Center-South Alternative is 51.5 miles long and will require two marine crossings: a 0.6 mile long crossing of Wrangell Narrows and a 1.2 mile long crossing of Duncan Canal. This route alternative is the same as the Center-North Alternative from Node T at the tap point to the existing TWP transmission line to Node T4 near Duncan Canal. It is also the same as the Center-North Alternative from Node S5 near Kake to Node K at the termination of the route in Kake. In total, the length of these common segments is 21.2 miles. Reference is made to the description provided for the Center-North Alternative as it pertains to the common segments.

Between Nodes T4 and T6, a 1.2 mile long segment, the route is in an area where there is not a USFS logging road. An access road would be built in this area adjacent to the line where half the length is in forested terrain and half is in muskeg. A submarine cable termination yard will be constructed at Node T6 where the 1.2 mile long submarine cable across Duncan Canal will connect to the overhead line. It is proposed that the bundled, 3-phase submarine cable have a similar approach to the water as was described previously for the Wrangell Narrows crossing. From field reconnaissance, the proposed location of the submarine cable across Duncan Canal appears very good although tidal currents and fishing vessel traffic may potentially be an issue that might require trenching of the cable along the entire crossing. The submarine cable would be connected to the overhead line at Node T7 at a similar cable termination facility as placed at Node T6.

The segment of the line route between Nodes T7 and T8 is 10.3 miles long, entirely in an area where there is no existing logging road. About 6.7 miles of the line is in an area of muskeg requiring very little clearing. An access road is proposed to be built adjacent to the line along the entire length of this segment. During the field reconnaissance the muskeg depth was

Photo 3 – Probing the depth of muskeg between Nodes T7 and T8.

measured and found to be approximately 6 feet deep. Although an attempt has been made to try and locate the line in higher ground in this area, it will still be a relatively difficult area to build the access road due to the extensive muskeg.

Between Nodes T8 and T11, the route follows the existing logging road for 3.4 miles and will be placed in a generally forested area without a road for 1.3 miles. The access from Kake will be good along this section of the route making road construction relatively straightforward. The route segment between Nodes T11 and S5 is 13.0 miles long and is adjacent to an existing logging road along the entire length. This segment is in a well logged over area and will require only minimal clearing of brush and small trees. Access from Kake is very good along this section of the route.

Woewodski Tap Alternative

The Woewodski Tap Alternative is a 13.6 mile long section of transmission line that can be added to the Center-North Alternative or the Center-South Alternative to provide power to a potential mining facility on Woewodski Island. It has been indicated by representatives of the Woewodski mining interests that if developed, facilities requiring power would most likely be on the east side of the island. The Woewodski Tap Alternative includes 5.2 miles of overhead line on Woewodski Island itself to deliver power from the north end of the island to the east side. The decision to build the Woewodski Tap would depend on whether or not a mining facility is eventually developed and whether or not it is deemed economically favorable to connect the mining load to the TWP-Kake power system.

The Woewodski Tap would begin at Node T3 with a connection to the KPTL[9]. A 7.6 mile long section of overhead line running south from Node T3 to Node T12 would be located on the Lindenberg Peninsula. Only about 2.1 miles of this segment length will be adjacent to existing logging roads, requiring about 5.5 miles of access road construction for the remaining portion of the segment. About two-thirds of the new section of road will need to be built in muskeg areas. Access to this section of the route will be relatively easy by means of the logging roads extending west from the Tonka log handling facility. This logging road on Lindenberg Peninsula, however, is isolated and is not connected to either Kake or Petersburg.

A 0.9 mile long submarine cable crossing of Wrangell Narrows between Nodes T12 and T13 will be required to deliver power to Woewodski Island. The submarine cable will require termination facilities to connect to overhead lines similar to those described for the crossing between Nodes T1 and T2 for the Center-North Alternative. The submarine cable will be buried in a trench along the length of this crossing since water depths are relatively shallow and this area is subject to high vessel traffic.

Between Node T13 on the north side of Woewodski Island and Node X, on the east side of the island, 5.2 miles of overhead line would be constructed. This entire segment length is to be

[9] It is presumed that the Woewodski Tap would only be built at some later date after the KPTL is constructed. As such, the section of the KPTL from Node T to Node T3 will be in place prior to construction of the Woewodski Tap. Alternatively, if it is constructed before the KPTL, the Woewodski Tap would need to include the line sections east of Node T3 and the interconnection to the TWP.

located in an area where there are no existing logging roads. It is important to note that the actual location of ore processing and handling facilities on Woewodski Island will determine the best location for the transmission line on the island. Additional study will be needed to define actual specifications for the Woewodski Tap when and if a mining facility is actually to be developed.

Northern Alternative (Old “Northern Route”)

The Northern Alternative is 66.0 miles long and generally traverses the north side of Kupreanof Island along the proposed route of the Kake – Petersburg road as proposed in the Southeast Alaska Transportation Plan. The Northern Alternative originates at the Petersburg substation where the TWP transmission line terminates. A 2.2 mile long overhead section of line would exit the substation and follow an existing gravel road generally in an east northeast direction to Frederick Sound. This line would be located behind Petersburg and somewhat near the airport. At Node S1 on Frederick Sound, a submarine cable termination facility would connect the overhead line to a 3.1 mile long submarine cable to be located northeast of the entrance to Wrangell Narrows.

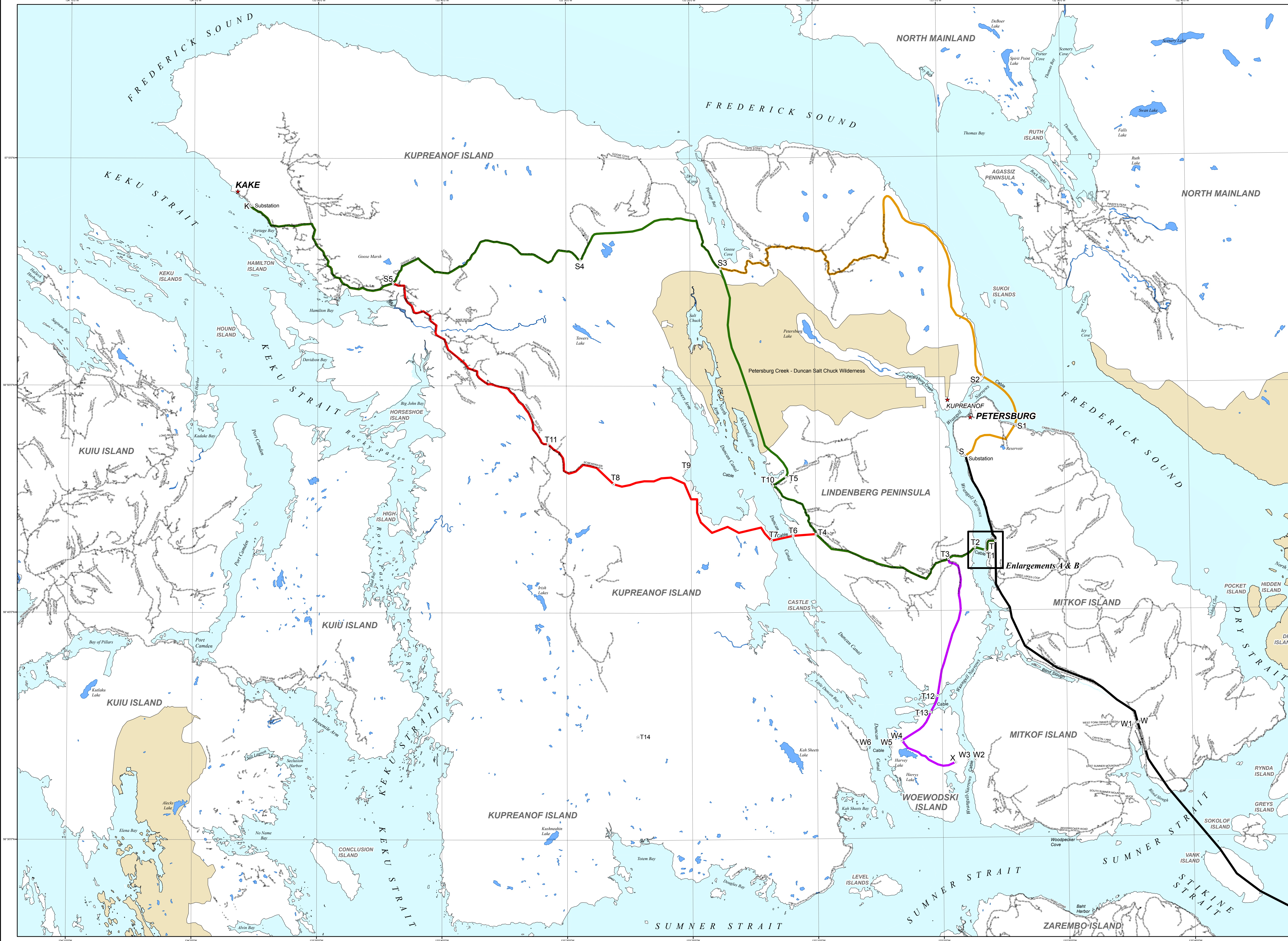
Photo 4 – Typical 69-kV submarine cable termination facility in a residential area.

Between Nodes S1 and S2 the submarine cable would be placed in a trench to a water depth of approximately 100 feet. At the shore ends the cable would be placed in split pipe or conduit for protection. The cable for this crossing would generally placed in somewhat deeper water to avoid anchor areas, fishing grounds and the dredging channel. The Wrangell Narrows entrance is a very busy channel and it will be important to place the submarine cable in deeper water to avoid much of the marine traffic and activity. The submarine cable is proposed to come ashore at Node S2 on Kupreanof Island, at a point potentially north of Five Mile Creek.

From Node S2, the route follows north along the Frederick Sound shoreline on the east side of Kupreanof Island and then cuts west to Node S3 located near the south end of Portage Bay. About half of the total 28.5 mile length of this segment is in an area where there is no logging road. Along Frederick Sound the route is situated on a fairly steep slope in a heavily forested area with numerous small streams and wash areas coming down off the hillside. An access road is proposed to be constructed along the line route in the area where no road currently exists. Near the point where the route turns west, 14.1 miles of the segment length will be located along an existing logging road.

From Node S3 to Node K in Kake, the Northern Alternative is the same as the Center-North Alternative. The description for this section of the route is provided in the description of the Center-North Alternative.

Photo 5 – Typical logging road and terrain on Kupreanof Island.



Proposed Route Alternatives (Node-Node Link Segments)

- Center - North (T, T1, T2, T3, T4, T10, T5, S3, S4, S5, K)
- Center - South [Least Expensive] (T, T1, T2, T3, T4, T6, T7, T8, T11, S5, K)
- Center - Woewodski Tap (T, T1, T2, T3, T12, T13, W4, X)
- Northern (S, S1, S2, S3, S4, S5, K)

Link Segment Node

T1 Identification/Node

Base Map Ground Features

- Shoreline
- USFS Road
- Existing Transmission Line
- Wilderness Boundary
- Fresh Water
- Salt Water

N W E S

0 10,000 20,000 30,000 40,000 50,000 60,000
Feet

0 2.5 5 7.5 10 12.5
Miles

Horizontal Datum: North American Datum of 1983 (NAD83).
Geographic Coordinate System (GCS): Alaska State Plane.
State Plane Zone: 1.
Federal Information Processing Standard (FIPS) Zone: 5001.
Projection: Hotine Oblique Mercator Azimuth Natural Origin.
Spheroid: Geodetic Reference System of 1980 (GRS 1980).
Linear Unit: US Feet.

ALASKA
Project Area

Basemap Source: US Forest Service, Petersburg Ranger District - Tongass National Forest (spatial vector/tabular data and black & white orthophotography - april 1997). USGS 7.5 minute series topographic quadrangle maps. Commonwealth Associates, Inc. PLS-CADD transmission line and right-of-way alignment models.

KAKE TO PETERSBURG TRANSMISSION INTERTIE
Potential 69 kV Transmission Line Route Alternatives

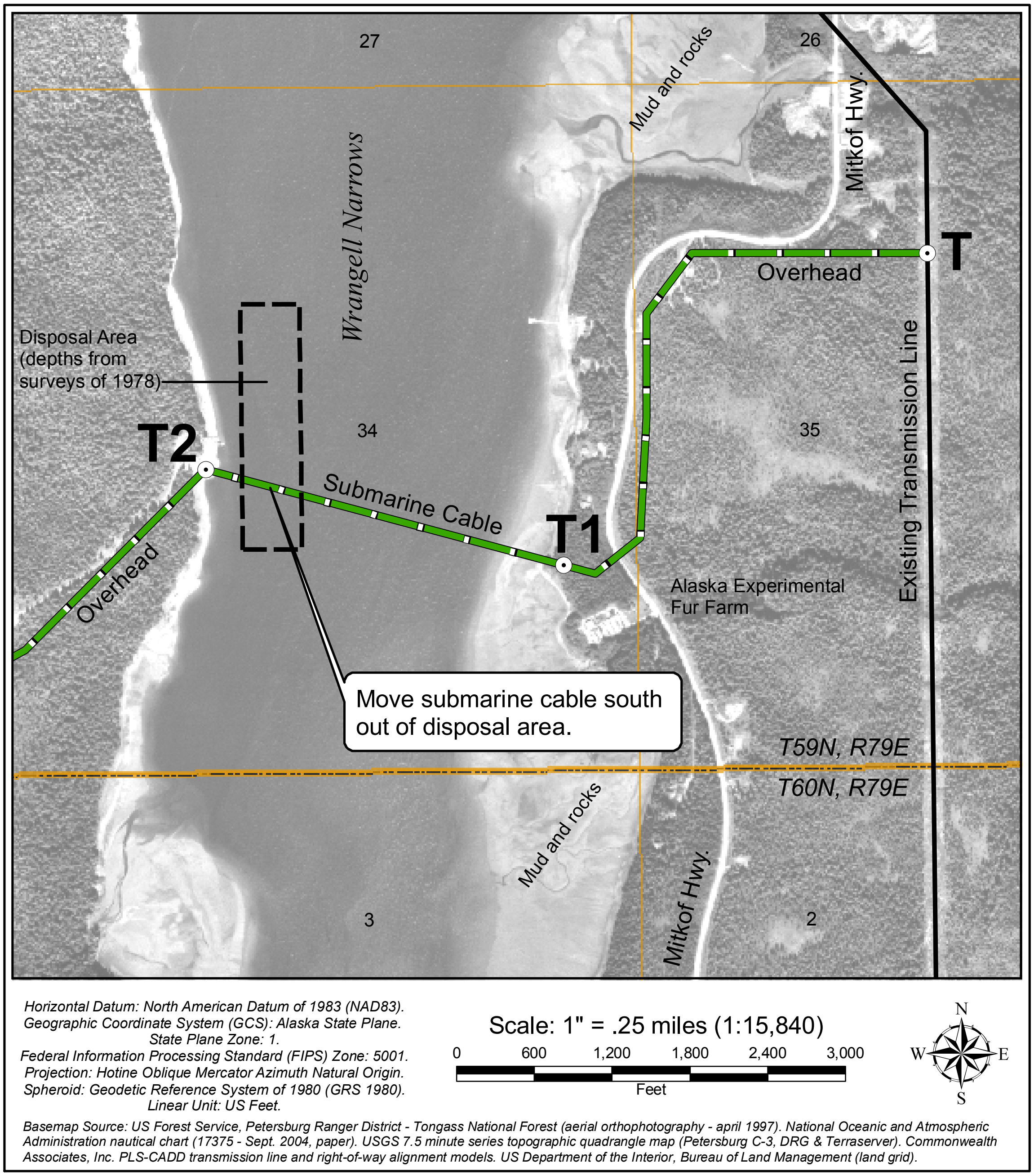
Southeast Conference

D Hittle & Associates, Inc.

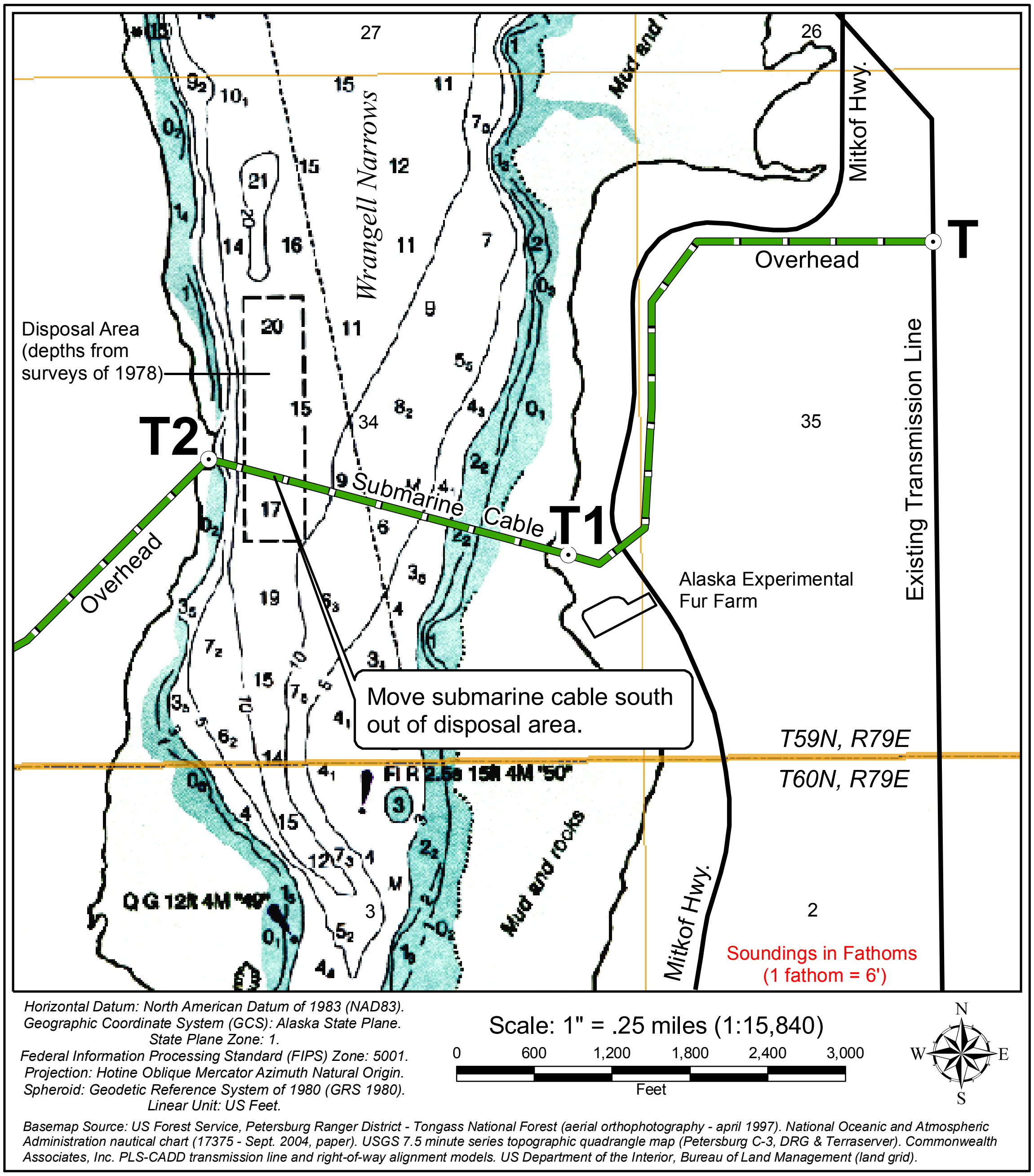
FIGURE 2-7

April 21, 2005

Commonwealth Associates, Inc.
engineers · consultants · construction managers



Enlargement A: Submarine crossing between segment nodes T1 and T2 over an aerial orthophotography background. Potential added expense/problems with disposal area.



Enlargement B: Submarine crossing between segment nodes T1 and T2 over a nautical chart background. Potential added expense/problems with disposal area.

Permitting Requirements and Environmental Process Overview

Introduction

As discussed in Section 2 of this report, there are two primary route alternatives to link Kake with the TWP power system, identified as the Center-North and Center-South Alternatives. A third route, the Northern Alternative, is being carried forward because it follows the proposed road route between Petersburg and Kake under consideration by the Alaska Department of Transportation and Public Facilities (ADOT&PF). Connecting Woewodski Island to the KPTL power system would require an additional, shorter utility corridor, called the Woewodski Tap.

The primary land owner in the vicinity of the KPTL, the U.S. Department of Agriculture, is responsible for the management of the Tongass National Forest within which lies the a significant majority of the land for the alternative corridors under consideration. Within this forest there are 18 Land Use Designations. Table 3-1 summarizes the Land Use Designations within the alternative routes by route segment. The USFS has developed management prescriptions for each of these land designations to help guide their management of natural resources within their responsibility. For an overhead utility corridor with an adjacent maintenance road, important management prescriptions include:

- Construction of the transmission lines (poles) per the USFS design criteria to minimize avian resource loss and minimize impacts to scenic viewsheds
- Maintenance of culverts and bridges associated with roadways to minimize aquatic resource impacts
- Avoidance of heritage resources
- Avoiding, minimizing, and possible mitigation of wildlife habitat fragmentation from construction of new roads.

Table 3-2 provides a more detailed listing of issues associated with alternative segments or links. Following is a summary of the environmental process and permitting requirements associated with each route alternative.

Northern Route

The segments or links that are unique to this route include the line from Node T to Node S3. This covers that portion of the route within the Petersburg City Limits, the crossing of the mouth of Wrangell Narrows, and the alignment through the scenic viewshed adjacent to Frederick Sound. This is the alignment that the ADOT&PF has selected as the preferred alignment for a road link between Petersburg and Kake (Southeast Alaska Transportation Plan (SATP), August 2004). In discussions with Andy Hughes, the SE Region Planning Chief, ADOT&PF has selected this route because it would require only one new ferry terminal (on Kupreanof Island) and avoids USFS wilderness designated lands. While this alignment would have construction-related issues not present in other potential road corridors, the avoidance of the wilderness, cost savings from needing only one new ferry terminal and the assumed ability to successfully apply application of the USFS scenic viewshed management prescriptions make this alternative ADOT&PF's preferred route.

Another aspect of this route that will contribute to the complexity of constructing a ferry terminal and road with or without an overhead transmission line is the Alaska Department of Natural Resources (DNR) designated Unit P-02, the coastal plan and foothills north of Prolewy Point (See Figure 3-2). This DNR Unit is being managed to protect the scenic views of Petersburg and visitors as well as being selected under NFCG 298 for the purpose of Community Expansion for the incorporated city of Kupreanof. According to DNR's Area Management Plan, this area is subjected to heavy weather limiting water access to vessels. The area is heavily used by marine life including marine mammals and waterfowl. Dense kelp beds along part of the shore provide protected fish habitat.

Using this route alignment for an overhead utility corridor could increase the potential impacts on avian resources. There are a relatively high number of eagle nest trees along the shoreline. While the road construction would also require work in this sensitive habitat, the overhead utility poles would also have a longer term potential for affecting birds from the increased possibility of electrocution.

To implement the Northern Alternative, the National Environmental Policy Act (NEPA) process would be required because of the Federal lands involved, Federal permits required, and the probability of the use of Federal funds. If this transmission line alternative is selected because of the expected ADOT&PF road and ease of line maintenance, the NEPA process would expect to cover both projects because they would be integrally combined.

The timing of potentially constructing a road between Kake and Petersburg has not been determined. There is an ongoing analysis of the potential affects of this road way on ferry schedules and services to Sitka, Petersburg, and the small Northern Panhandle communities. The results of that analysis will be contained in an update to the SATP to be released during the third quarter of 2005. Whether or not the ADOT&PF maintains its intent to construct this road, the Kake to Petersburg road is not a high priority capital project and would not be expected to be implemented for several years.

Center-North Alternative (Wilderness)

The unique component of the Central route is the portion of the alignment through the Petersburg Creek - Duncan Salt Chuck Wilderness. The Tongass Land Management Plan (TLMP) designation for Wilderness states (page 3-15) the following:

> This Land Use Designation represents a Transportation and Utility System (TUS) "Avoidance Area." Transportation and utility sites and corridors may be located in this Land Use Designation only after an analysis of potential TUS opportunities has been completed and no feasible alternatives exist outside this Land Use Designation.

The "feasibility" issue will make this alternative difficult to select because, based on the analysis of the Center-South Route presented in this report, there is a feasible alternative. While initial work on utility corridor identification in the 1970's found this route the most environmentally appropriate corridor, under the current Wilderness status, this route is not as viable as it once was. According to P. Grantham, Petersburg Ranger District Supervisor for the Tongass National Forest, there are possible, although relatively difficult, ways to implement a utility corridor through this Wilderness. Regardless of how the proponent receives permission to build the Center-North Route, it would take an Act of Congress to place a transmission line in the Wilderness. Ways to facilitate receiving permission include:

- Get consensus of all the pertinent local environmental groups to say this is the best alternative. This would take a fair amount of documentation but could be achievable.

- Offer a different parcel of land that could be transferred into the Wilderness or a parcel that could be designated National Forest Land. This is also known as a "land swap".

Land swaps are relatively controversial and not recommended by the U.S. Forest Service. The costs of obtaining the Act of Congress or the work leading up to it are not included in the cost estimates presented in this report. The costs for the Center-North Alternative are shown to be higher because of the costs of local early scoping efforts and EIS preparation involving a route not within a designated utility corridor. If the Act of Congress is passed prior to the initiation of the EIS process, the EIS costs shown in Table 3-5 might be lowered.

Center-South Route

There are two unique issues associated with the Southern Route: the Duncan Canal crossing and the 10.3 miles of roadless area that is within an important flyway zone directly west of the Duncan Canal crossing (the Duncan Canal Salt Chuck Waterfowl Habitat). According to DNR's Resource Management Plan for this region, there are important starry flounder nurseries and fishing grounds as well as shrimp trawl fishing areas within the vicinity of the cable crossing. Fishermen who rely on the Dungeness crab fishery also indicate that the Duncan Canal is a very important crab nursery and rearing habitat. The DNR may require the cable be buried along its entire length in order to protect the habitat, fishing grounds, and integrity of the cable itself.

Due west of the Duncan Canal crossing is an important waterfowl flyway. Early reconnaissance work by staff with the Alaska Department of Fish and Game (ADF&G) found that a utility corridor within or near the flyway would have a large effect on the safety of the waterfowl using that flyway. The potential for service interruptions would also be greater if the power lines are within the flight path of these birds. ADF&G staff recommended that the alignment be moved south, closer to the bluffs of the nearby plateau so that the poles would be below the primary flyway height. We recommend that during final alignment design, members of ADF&G and DNR-Office of Habitat and Permitting (DNR-OHMP) be part of the alignment team to ensure avoidance and minimization of waterfowl conflicts.

Environmental and Permitting Issues in Common

Along all alternative routes there would be the following resource issues and permitting requirements:

Stream crossings – Anadromous streams crossed would require a permit from DNR—OHMP. The utility pole placement is expected to avoid streams but the maintenance roadway would likely be culverted or bridged. These roads and their associated culverts and drainages would be required to be placed and constructed per the TLMP transportation prescriptions.

Avoidance of stream crossings where possible and minimization of impacts would be expected as part of the NEPA process. For those unavoidable locations, some sort of mitigation is generally required. Upgrading existing failing culverts, drainages, and other stream structures that would occur during project implementation could be counted as mitigation.

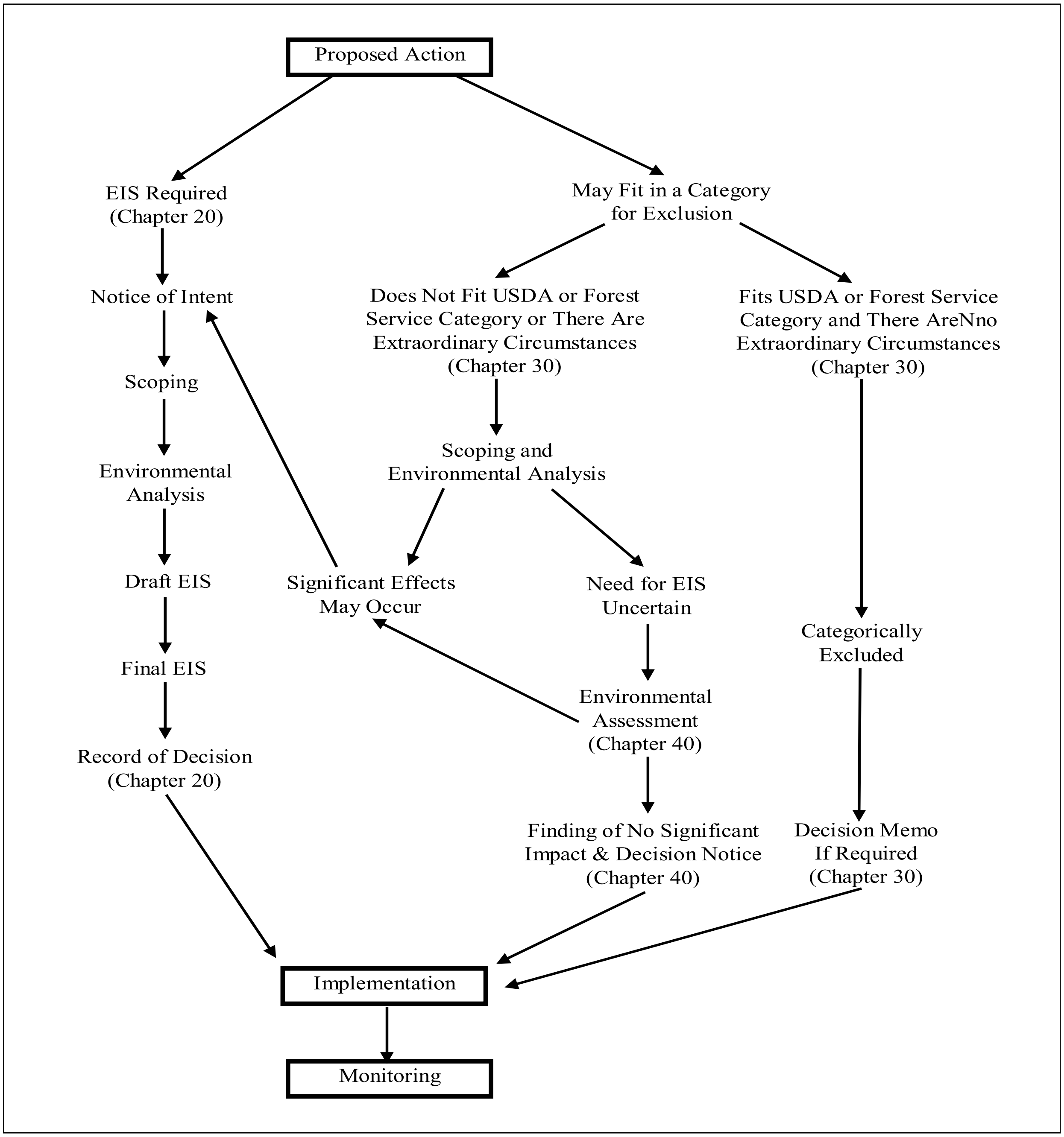
Eagle nests – Eagles and their nests are under the protection of the US Fish and Wildlife service. Nest trees may not be removed and if construction would occur within a certain distance of a nest tree, construction windows may be applied as a permit condition or observers could be required during construction.

Wrangell Narrows crossing - The Northern Route would cross the Narrows at its mouth while the Center-South and Center-North routes would cross near the old experimental fur farm south of Petersburg. The Wrangell Narrows is a major shipping channel for Alaska Marine Highways, cruise ships, and freight haulers. Some coordination with these entities would be expected during construction.

National Environmental Policy Act Process

Figure 3-1 diagrams the National Environmental Policy Act (NEPA) process as implemented by the U.S. Department of Agriculture/U.S. Forest Service (Forest Service Handbook, 1909.15, page 13 of 15; Approved: June 29, 2004).

FIGURE 3-1
NEPA Process Overview



Under NEPA, if a project is not allowable under a categorical exclusion and there is uncertainty regarding the potential impacts, the project proponent can conduct an Environmental Assessment (EA). In some cases, if a corridor is a designated utility corridor, an EA could be considered adequate to verify that a proposed transmission line project is compatible with that designation.

However, under the current NEPA implementation protocols of the U.S. Forest Service, the EA and Environmental Impact Statement (EIS) processes are becoming more similar and the threshold for what could be significant is dropping[10]. The U.S. Forest Service recommends that a proponent expect their project be analyzed under the EIS process, thus removing the uncertainty of the overall process.

A summary of agency requirements and associated costs is provided in Table 3-3. The estimated costs of technical analyses in support of the NEPA and permitting process are provided in Table 3-4. A summary of the estimated cost for the NEPA documentation process is provided in Table 3-5.

[10] Personal communication D. Rogers, U.S. Forest Service with J. Gendron, CH2M Hill; July 20, 2005.

TABLE 3-1
(Page 1 of 3)
Comparable Land Use Designations and Affected Resources by Line Segment

Resource	K-S5	S5-S4	S4-S3	S3-P2	P2-S2	S2-S1	S1-S	S3-T5
Air	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Beach & Estuary						*Frederick Sound crossing*		
Facilities	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Fire	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Fish	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
anadromous (#of stream crossings)	2	4	8	4	12	0	3	12
resident (# of stream crossings)	7	7	10	6	29	0	3	17
Habitat area of concern identified by ADF&G		*Cathedral Falls*						
Forest Health	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Heritage Resources	Yes	No	No	No	Yes	No	Yes	Yes
Lands	NNF, TM, ML	TM	TM, ML	TM	TM, SV, OG, SM	NA	NNF	TM, WW, OG, ML
Minerals and Geology*								Mineral Feature Type: Precious
Recreation and Tourism	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Riparian	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Rural Community Assistance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Scenery					Scenic Viewshed			
Soil and Water	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subsistence	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Threatened and Endangered Species (and other protected species)						Possible		
Eagles	Yes				Yes		Yes	
Timber	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Trails	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Transportation	Existing roads	Existing roads	Existing roads/ Roadless	Existing roads	Existing roads/ Roadless	Marine Highway	Roadless	Roadless
Wetlands	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Wildlife/Habitat area of concern identified by ADF&G				*Portage Bay Waterfowl Habitat*		*Protewy Point*		

Land Use Codes
NNF = Non-National Forest
TM = Timber Production
ML = Modified Landscape
SV = Scenic Veiwshed
OG = Old Growth Habitat
SM = Semi-Remote Recreation
WW = Wilderness

TABLE 3-1
(Page 2 of 3)
Comparable Land Use Designations and Affected Resources by Line Segment

Resource	T5-T4	T4-T3	T3-T2	T2-T1	T1-T	T-S	S5-T11
Air	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Beach & Estuary				*Wrangell Narrows crossing*			
Facilities	Yes	Yes	Yes	No	Yes	No	Yes
Fire	Yes	Yes	Yes	No	Yes	Yes	Yes
Fish	Yes	Yes	Yes	Yes	Yes	Yes	Yes
anadromous (#of stream crossings)	2	5	0	0	0	2	3
resident (# of stream crossings)	4	6	0	0	0	7	9
Habitat area of concern identified by ADF&G							*Cathedral Falls, Hamilton Creek, Big John Creek*
Forest Health	Yes	Yes	Yes	No	Yes	No	Yes
Heritage Resources	No	No	Yes	No	No	Yes	No
Lands	ML, TM	ML, TM, SV	SM	NA	ML, TM	NNF	TM, OG, SV
Minerals and Geology*							
Recreation and Tourism	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Riparian	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rural Community Assistance	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Scenery		Scenic Viewshed					Scenic Viewshed
Soil and Water	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subsistence	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Threatened and Endangered Species (and other protected species)							
Eagles			Yes			Yes	
Timber	Yes	Yes	Yes	No	Yes	Yes	Yes
Trails	Yes	Yes	Yes	No	Yes	No	Yes
Transportation	Existing roads/ Roadless	Existing roads	Existing roads	Marine Highway	Roadless	Roadless (existing intertie)	Existing roads
Wetlands	Yes	Yes	Yes	No	Yes	Yes	Yes
Wildlife/Habitat area of concern identified by ADF&G							

Land Use Codes
NNF = Non-National Forest
TM = Timber Production
ML = Modified Landscape
SV = Scenic Veiwshed
OG = Old Growth Habitat
SM = Semi-Remote Recreation
WW = Wilderness

TABLE 3-1
(Page 3 of 3)
Comparable Land Use Designations and Affected Resources by Line Segment

Resource	T11-T8	T8-T7	T7-T6	T6-T4	T3-T12	T12-T13	T13-W4	W4-W3
Air	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Beach & Estuary			*Duncan Canal crossing*					
Facilities	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Fire	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fish	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
anadromous (#of stream crossings)	3	16	0	1	10	0	1	1
resident (# of stream crossings)	7	18	0	2	13	0	2	3
Habitat area of concern identified by ADF&G								
Forest Health	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Heritage Resources	No	No	No	Yes	No	No	Yes	No
Lands	TM	TM, OG, SM	NA	ML, TM	ML, SV, OG, NNF	NA	SV	SV, ML
Minerals and Geology*								Mineral Feature Type: Polymetallic
Recreation and Tourism	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Riparian	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rural Community Assistance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Scenery					Scenic Viewshed		Scenic Viewshed	Scenic Viewshed
Soil and Water	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subsistence	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Threatened and Endangered Species (and other protected species)								
Eagles		Yes		Yes				
Timber	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Trails	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Transportation	Existing roads/ Roadless	Roadless		Roadless	Existing roads/ Roadless	Roadless	Roadless	Roadless
Wetlands	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Wildlife/Habitat area of concern identified by ADF&G		*Duncan Canal Salt Chuck Waterfowl Habitat*						

Land Use Codes
NNF = Non-National Forest
TM = Timber Production
ML = Modified Landscape
SV = Scenic Veiwshed
OG = Old Growth Habitat
SM = Semi-Remote Recreation
WW = Wilderness

TABLE 3-2
(Page 1 of 3)
Land Use Issues

Segment ID	Designation/Resources	Northern	Center-North	Center-South	Woewodski Tap
T-S	Non-national Forest Service Land. A combination of private, Mental Health Trust, and State land ownership. Fish (# of crossings): Anadromous = 2 Resident = 7 Heritage Resources = Yes Eagle nests = Yes	X			
S-S1	Non-national Forest Service Land. A combination of private, Mental Health Trust, and State land ownership. In the vicinity of the Sandy Beach public recreation area and would cross the City Creek Open Space. Fish (# of crossings): Anadromous = 3 * Resident = 3 Heritage Resources = Yes	X			
S1-S2	Under water cable across mouth of Wrangell Narrows. DNR designated Unit PT-36; Habitat, harvesting, and shoreline uses. Productive marine and avian resource area. Important wildlife viewing area. Essential fish habitat (EFH) analysis and Biological Assessment (BA) needed, marine mammals present including whales.	X			
S2-S3	Tongass National Forest; approximately 124 acres of timber production, approximately 20 acres of old growth habitat, semi-remote recreation, and scenic viewshed; some existing roads but roadless along Frederick Sound. Fish (# of crossings): Anadromous = 12* Resident = 29 Heritage Resources = Yes Eagle nests = Yes	X			
S3-S4	Approximately 75 acres timber production. Fish (# of crossings): Anadromous = 8* Resident = 10 Heritage Resources = No	X	X		

TABLE 3-2
(Page 2 of 3)
Land Use Issues

Segment ID	Designation/Resources	Northern	Center-North	Center-South	Woewodski Tap
S4-S5	Approximately 116 acres timber production. Fish (# of crossings): Anadromous = 4 Resident = 7 Heritage Resources = No	X	X		
S5-K	Land ownership includes USFS, Native lands, and a section of State select lands (DNR Unit U-05). The state land is the Headwaters of Little Gunnuk Creek & Gunnuk Creek, a portion of the municipal watershed. The route alignment is primarily to the south of the main portion of the headwaters along existing USFS logging roads. No old growth forest, approximately 42 acres of timber production. Fish (# of crossings): Anadromous = 2 Resident = 7 Heritage Resources = Yes Eagle nests = Yes	X	X	X	
T-T1	Non-national Forest Service Land—private owners and Mental Trust Lands.		X	X	
T1-T2	Under water cable—not Tongass Essential fish habitat assessment needed for cable crossings. Potential biological assessment needed for Wrangell Narrows.		X	X	
T2-T3	USFS Log Transfer facility within the vicinity of potential alignment Fish (# of crossings): Anadromous = 0 Resident = 0 Heritage Resources = Yes Eagle nests = Yes		X	X	
T3-T4	Land use includes modified landscape and approximately 66 acres of timber production. Fish (# of crossings): Anadromous = 5 Resident = 6 Heritage Resources = No		X	X	
T4-T6	Land use includes modified landscape and approximately 5 acres of timber production. Fish (# of crossings): Anadromous = 1 Resident = 2 Heritage Resources = Yes			X	
T6-T7	Under water cable—not Tongass			X	
T7-T8	Land use includes semi-remote recreation and approximately 13 acres of timber production. Fish (# of crossings): Anadromous = 16 Resident = 18 Heritage Resources = No			X	

TABLE 3-2
(Page 3 of 3)
Land Use Issues

Segment ID	Designation/Resources	Northern	Center-North	Center-South	Woewodski Tap
T8-T11	Land use includes semi-remote recreation, approximately 15 acres of old growth forest and approximately 65 acres of timber production. Fish (# of crossings): Anadromous = 3 Resident = 7 Heritage Resources = no			X	
T11-S5	Land use includes scenic viewshed, approximately 4 acres of old growth forest and approximately 36 acres of timber production. Fish (# of crossings): Anadromous = 3 Resident = 9 Heritage Resources = No			X	
T4-T5	Land use includes modified landscape and approximately 7 acres of timber production. Fish (# of crossings): Anadromous = 2 Resident = 4 Heritage Resources = No		X		
T5-S3	Land use includes wilderness area, approximately 13 acres of old growth forest and approximately 8 acres of timber production. Fish (# of crossings): Anadromous = 12* Resident = 17 Heritage Resources = Yes		X		
T3-T12	Land use includes scenic viewshed, modified landscape and approximately 36 acres of old growth forest. Fish (# of crossings): Anadromous = 11* Resident = 3 Heritage Resources = No				X
T12-T13	Under water cable—not Tongass Essential fish habitat assessment needed for cable crossings.				X
T13-W4	Land use includes scenic viewshed. Fish (# of crossings): Anadromous = 1* Resident = 1 Heritage Resources = No				X
W4-W3	Land use includes scenic viewshed and modified landscape.. Fish (# of crossings): Anadromous = 1* Resident = 2 Heritage Resources = No				X

TABLE 3-3 (Page 1 of 4)
Summary of Agency Requirements and Associated Costs

Agency/ Requirement	**Description**	**Associated Cost Items**
Federal Agencies		
U.S. Army Corp of Engineers:	**Authority to regulate work in waters of the U.S.**	**Permitting costs only, no NEPA process required**
Section 10 Permit	Permit and condition work in navigable waters	Costs will be associated with meetings with the Corps staff, preparation of and finalization of permit drawings, mitigation measures required by NMFS and/or USFWS
Section 404 Permit	Permit and condition work in wetlands	
Other	Notify NOAA and NOS of underwater cables	
U.S. Forest Service **Lead NEPA Agency**	**Permission to Work in the Tongass National Forest** **and** **Responsible for compliance with the National Environmental Policy Act (NEPA)**	**The major costs would be:**
Special Use Authorization	Through the NEPA process, USFS will evaluate purpose and need of project, evaluate potential impacts, select the alternative, and condition the project. The USFS will use compliance with the Tongass National Forest *Land & Resource Management Plan* (1997), Forest Plan to base their determination of impacts	Preparation of needed NEPA documents and funding for USFS administration of those processes. Typically, the proponent would hire a consultant to conduct the appropriate NEPA process. That process will depend on the potential for the project to have significant environmental impacts. If the preferred alignment and design is such that the USFS determines that there would be no significant impacts, an Environmental Assessment (EA) may suffice. The EA would verify that determination. If the design and route selected might result in significant impacts, an Environmental Impact Statement would be needed. Under either an EA or EIS, the proponent would pay for the scoping process, technical analyses needed to verify no impacts or determine what impacts there might be, and a draft and final document.
Construction Permit	5-year permit to construct. Bonding required.	Bonding amount equivalent to cost to restore forest.
Easement Fee	Long-term lease (50 years)	5 percent of fair market value. USFS would appraise land value
Timber sales	Purchase of timber that would be removed by project	USFS or third party would appraise and harvest.

TABLE 3-3 (Page 2 of 4)
Summary of Agency Requirements and Associated Costs

Agency/ Requirement	**Description**	**Associated Cost Items**
Federal Agencies (cont.)		
U.S. Fish and Wildlife Service	**Authority to uphold Endangered Species Act** Might require Biological Assessment (BA) if deemed needed. Review and condition federal permit applications	Costs might be needed to do BA or for mitigation or monitoring, no major issues identified at this time.
NOAA/ National Marine Fisheries Service	**Authority to uphold Endangered Species Act and Magnuson-Stevens Act (EFH)** Might require BA if deemed needed.	An Essential Fish Habitat Analysis would be required. If the potential for impact was found, mitigation measures including redesign and/or monitoring would be required and conditions incorporated into the appropriate permit. Costs might be needed to do BA or for mitigation or monitoring, costs for marine habitat survey and report.
U.S. Environmental Protection Agency	**Clean Water Act—Storm Water Quality**	Construction Storm Water Pollution Prevention Plan
U.S. Coast Guard	**Update Navigation Charts** The underwater cable locations would be provided to the USCG for incorporation into navigational charts.	No additional costs
State of Alaska Agencies		
Department of Natural Resources—Office of Project Management and Permitting	Coastal Zone Management Plan consistency	Costs associated with permit application and NEPA documentation preparation (costs for NEPA covered under USFS), pre-submittal meeting, and potential subsequent conditions and mitigation.
Department of Natural Resources—Division of Lands	Easements across state lands including shorelines and subtidal areas. Early entry permit (valid for 1 year prior to construction) Right-of-Way Permit	Costs: $100 filing fee for each easement plus Annual ROW lease based on location.

TABLE 3-3 (Page 3 of 4)
Summary of Agency Requirements and Associated Costs

Agency/ Requirement	**Description**	**Associated Cost Items**
State of Alaska Agencies (cont.)		
Department of Natural Resources—Office of Habitat Management and Permitting	**Title 41** Fishway Act and Anadromous Fish Act	There are multiple anadromous fish streams crossed by all routes under consideration. While the Intertie is proposed as an above ground system, the construction of the associated maintenance roads in current road less areas may require permits to work in anadromous fish streams. Use of existing roads will lessen the number of permits. Also upgrading culverts and road crossings across fish streams may be offered as mitigation potential impacts. This would be determined during route selection, design, the NEPA process, and permitting.
Department of Fish and Game	**Title 16 Refuges and Critical Species Habitat Permits**	Special area permit is needed to work within State of Alaska Refuges, Critical Habitat Areas, and Sanctuaries. The project area is not within such an area.
Department of Transportation & Public Facilities	**Utility permit** Permit application for lines within a DOT right of way.	$400 per permit plus $0.25/lineal foot to a maximum of $2,500.
State Historic Preservation Officer	Section 106 of the National Historic Preservation Act	Costs of an analysis of the presence or potential presence of cultural or historic sites including a records search and field investigation. Oversight during construction may be required if high potential is found.

TABLE 3-3 (Page 4 of 4)
Summary of Agency Requirements and Associated Costs

Agency/ Requirement	**Description**	**Associated Cost Items**
State of Alaska Agencies (cont.)		
Department of Environmental Conservation	Clean Water Act; Clean Air Act	Short term variance from Water Quality Standards for runoff and/or work in waters of the state. General permit for remote worker camps if used. Review of potential for hazardous waste sites along routes. Determination of compliance with National Ambient Air Quality Standards (NAAQS) for particulate generation and emissions from construction equipment and vehicles. Approval of the specific plans developed under Federal Storm Water General Permit.
Local Governments		
Petersburg	Planning and zoning Review—primarily done under coastal zone management program	None
Kake	Planning and zoning Review—primarily done under coastal zone management program	None
Kupreanof	If alignments are within the Kupreanof city limits, there would be a planning and zoning review.	None
Government to Government Relations		
Kake Tribal Corporation	Consult on issues that could affect the tribe including their traditional way of life, properties with traditional religious and cultural significance (per Section 106 of the National Historic Preservation Act), and subsistence.	The tribe may request funds to cover their costs to analyze the presence or potential presence of cultural or historic sites. This may be in addition to an independent analysis for the SHPO.
Petersburg Indian Association	Consult on issues that could affect the tribe including their traditional way of life, properties with traditional religious and cultural significance (per Section 106 of the Natl. Historic Preservation Act), and subsistence.	The tribe may request funds to cover their costs to analyze the presence or potential presence of cultural or historic sites. This may be in addition to an independent analysis for the SHPO.

TABLE 3-4 (Page 1 of 4)
Estimated Costs of Technical Analyses in Support of NEPA and Permitting Process

Resource	Technical Analyses expected for NEPA process	Costs for Northern Route	Costs for Central--North Route	Costs for Central--South Route
Air	Construction equipment--analyze impacts	< $5K	< $5K	< $5K
Beach & Estuary	Channel crossings will need to be designed per conditions placed by OPMP (Coastal Zone). An analysis of consistency with CZMP will be part of NEPA. Impacts to Essential fish habitat are covered below under "Fish"	15	15	25
Facilities	Short analysis in NEPA	<$1K	<$1K	<$1K
Fire	Short analysis in NEPA	<$2K	<$2K	<$2K
Fish	<u>The following are related:</u>			
	Stream crossing impacts must be analyzed. There could be up to 50 stream crossings with many having anadromous fish habitat. The maintenance road for the transmission line will cross these streams and habitat will need to be protected.	Field work = $30K; analysis = $10K	Field work = $30K; analysis = $20K	Field work = $40K; analysis = $20K
	Fish habitat protection and enhancement, mitigation measures developed and designed	Mitigation/enhancement design = $20K	Mitigation/enhancement design = $20K	Mitigation/enhancement design = $20K
	Essential Fish Habitat analysis (estuary and streams) and working with NMFS for approval of project	analysis = $25K	analysis = $30K	analysis = $30K
Forest Health	Short analysis in NEPA	$2K	$3K	$2K

TABLE 3-4 (Page 2 of 4)
Estimated Costs of Technical Analyses in Support of NEPA and Permitting Process

Resource	Technical Analyses expected for NEPA process	Costs for Northern Route	Costs for Central--North Route	Costs for Central--South Route
Heritage Resources	This analysis will be a detailed one and will need to incorporate Tribal entities. Field work, tribal correspondence, SHPO correspondence and file review.	$50K	$60K	$40K
Lands	This is essentially the application for special use of FS lands. Minor additional funds needed to describe process in NEPA and fill in applications. additional effort needed for wilderness route	5K	***50-100***	5K
Minerals and Geology	short analysis in NEPA	4K	4K	4K
Recreation and Tourism	moderate analysis in NEPA	10K (alignment in Petersburg goes through recreation area)	6K	6K
Riparian	This is covered under the Fish Section			
Rural Community Assistance	Economic analysis of the project to demonstrate impact to rural community. Use existing economic analyses in the NEPA document	3K	3K	3K
Scenery	If design/pole placement follows prescriptions detailed in the TLMP, minimal analyses would be needed.	10K	5K	5K
Soil and Water	Hydro geologist and soil scientist working with the fisheries biologist to analyze soil conditions and develop construction techniques and design components that protect water quality and fishery resources	20K	20K	20K

TABLE 3-4 (Page 3 of 4)
Estimated Costs of Technical Analyses in Support of NEPA and Permitting Process

Resource	Technical Analyses expected for NEPA process	Costs for Northern Route	Costs for Central--North Route	Costs for Central--South Route
Subsistence	Research existing use of project area for subsistence (work with tribal, state, and FS staff); analyze potential impact from improved access.	$15K	$15K	$15K
Threatened and Endangered Species (and other protected species)	Research presence of protected species including bald eagle nests and migratory bird flyways and determine potential impacts. Protected species would be documented in a Biological Assessment. If listed marine species, such as stellar sea lion, is present in Wrangell Narrows and/or Duncan Canal, this would require a BA.	10-40 K	10-40 K	10-40 K
Timber	For the NEPA process, an analysis of potential impacts to overall timber harvest plan would be done. Most of this would be by the FS staff. Price of timber cut for construction/implementation would be analyzed outside of NEPA.	5K	5K	5K
Trails	Analyze potential impacts to existing trails or development of additional trails	2K	5k	2K
Transportation	Analyze impacts from improved community access using existing roads and addition of roads into roadless areas. Much of this analysis would focus on subsistence and recreation.	5K	5K	5K

TABLE 3-4 (Page 4 of 4)
Estimated Costs of Technical Analyses in Support of NEPA and Permitting Process

Resource	Technical Analyses expected for NEPA process	Costs for Northern Route	Costs for Central--North Route	Costs for Central--South Route
Wetlands	Wetlands must be avoided, impacts minimized, and/or mitigated. Wetlands would be delineated during preparation of the NEPA document. Wetland scientists working with designers/engineers can identify where avoidance and minimization can occur. Value of impacted wetlands determined and used during application for Section 404 permit with the USACOE. Loss of wetlands could be mitigated through restoration/enhancement of other local impacted wetlands or by contributions to a wetland mitigation bank.	$40K; only for NEPA, not for mitigation	$50K; only for NEPA, not for mitigation	$50K; only for NEPA, not for mitigation
Wildlife/Habitat	Existing wildlife and their habitat in project area would be described. Some field work would be expected. Potential impact analyzed. Focus on subsistence species and waterfowl. Primary aspects of the project that could affect wildlife include the placement of poles within a migratory bird flyway (West of Duncan Canal crossing) and wildlife habitat fragmentation by new maintenance road in roadless area. Also, increased access to hunting areas could affect large and small game populations	Field work = $40K; analysis = $20K	Field work = $40K; analysis = $20K	Field work = $40K; analysis = $20K
	Cost Estimate in Thousands	**$370.5**	**$439.5**	**$399.5**

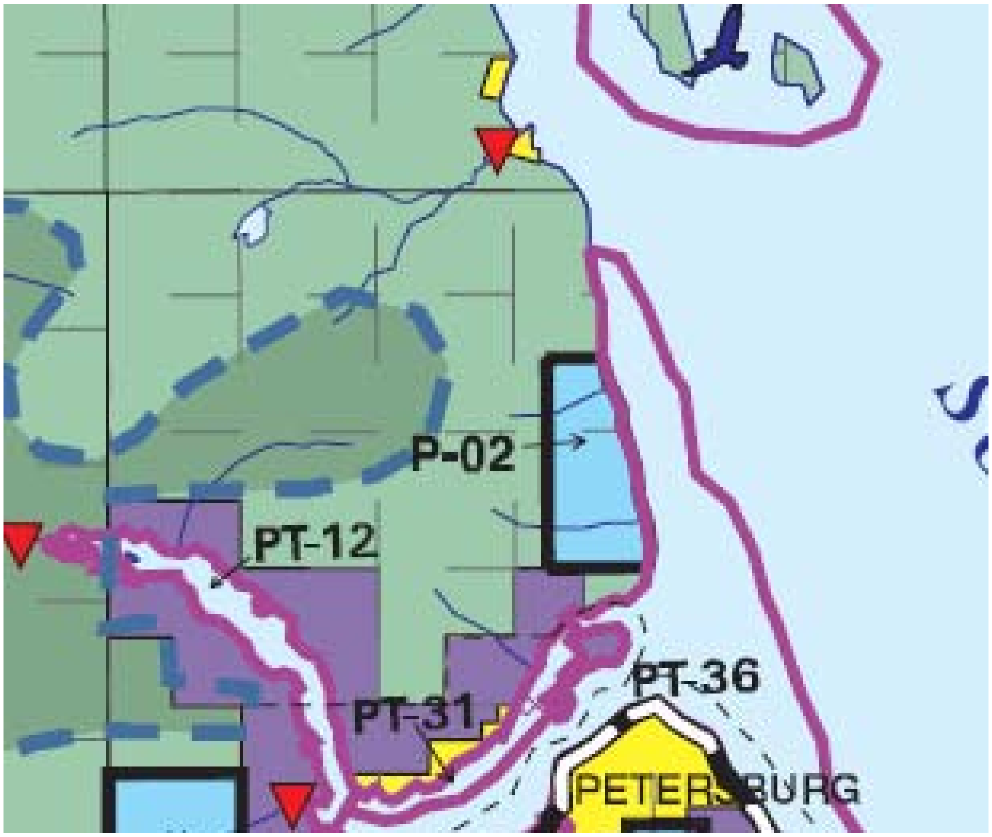
Resources in bold Italics are those that will be important in the impact analysis.

TABLE 3-5
Estimated Cost for NEPA Documentation Process
($000)

Process Phase	Process Activity	Costs for Northern Route	Costs for Center-North Route	Costs for Center-South Route
Scoping				
	Scoping Plan Development	10	15	10
	Project administration/management	15	20	15
	Agency Scoping	10	25	10
	Public Scoping	10	20	10
	Scoping Summary	10	25	10
	Environmental documentation work plan	5	15	5
If Environmental Assessment				
	Scoping (sum of above)	60	NA [a]	60
	Technical Analyses	370.5	NA	400
	Preliminary Draft EA	150	NA	100
	Draft EA	100	NA	50
	Final EA	75	NA	40
	Finding of No Significant Impact	5	NA	5
	Estimated total for an EA (thousands)	**$ 761**		**$ 655**
If no FONSI then: Environmental Impact Statement				
	Notice of Intent		3	
	Scoping		120	
	Technical Analyses		440	
	Preliminary Draft EIS		250	
	Draft EIS		150	
	Final EIS		100	
	Record of Decision		15	
	Estimated total for an EIS (thousands)		**$ 1,078**	

[a] = Assumption is that, for the central north route through the wilderness, an EIS would be the required level of environmental documentation needed for NEPA compliance

FIGURE 3-2
Prolewy Point Management Unit Description Pertinent to Northern Route



Management Intent

Unit P-02 (MTRS T.085S.,R.079E., Sections 10 and 15)

Parcel is to be retained by the state and managed to preserve its viewshed and habitat values. Land disposals are not appropriate because of the rugged topography and the difficulty of access, including water access since the prevailing winds make landing difficult.

Resources/Uses for which Unit is to be Managed

Name: Coastal plain and foothills north of Prolewy Point (Kupreanof Island)

Parcel is directly adjacent to the mouth of Wrangell Narrows and is very visible from Petersburg, and to ferry/cruise ship routes. It acts as an important part of the northern viewshed for the community.

Parcel Descriptions and Related Information:

Acres: 600 Designations: Ru = Public Recreation & Tourism-Undeveloped

Parcel consists of a flat coastal edge, but western edge slopes go up steeply upwards Petersburg Mountain. Coastal areas are directly affected by Frederick Sound storms, precluding easy marine access. Adjacent tidelands contain an extensive and very productive tideflat along Frederick Sound, wintering habitat for large numbers of waterfowl. Seals and other marine mammals use this area heavily. An extensive kelp bed runs along this shoreline which provides shelter for fish species. This parcel was selected under NFCG 298 for the purpose of Community Expansion. Adjacent uplands are designated Scenic Viewshed and in the northwest portion, Wilderness (Duncan Salt Chuck Wilderness).

Other

- Red triangles on map designate anadromous fish stream.
- Yellow designated areas are privately owned
- The drab green area within the dashed line is the Duncan Salt Chuck Wilderness area.
- Lighter green is Tongass National Forest Land
- Purple is Mental Health Land.

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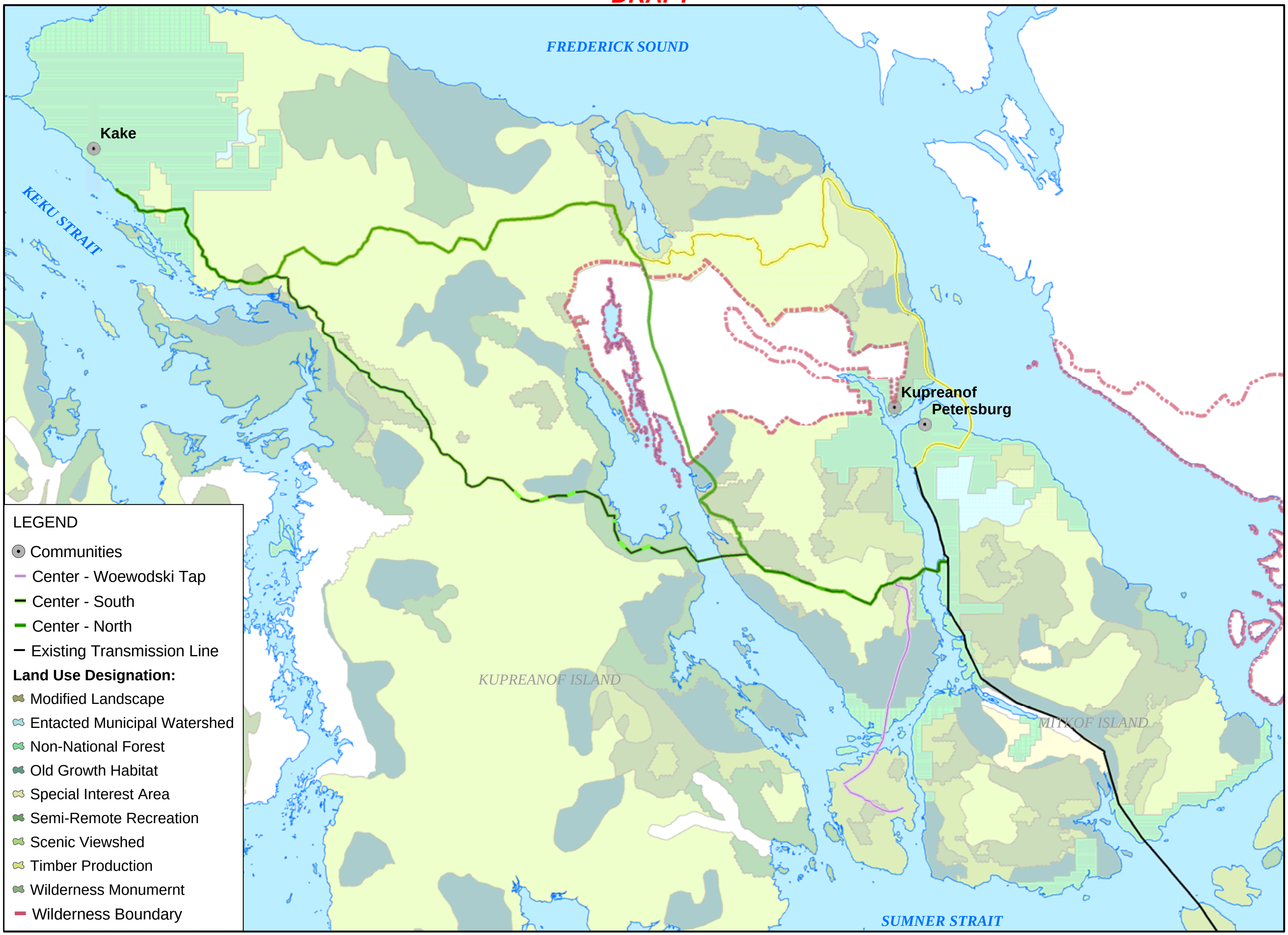
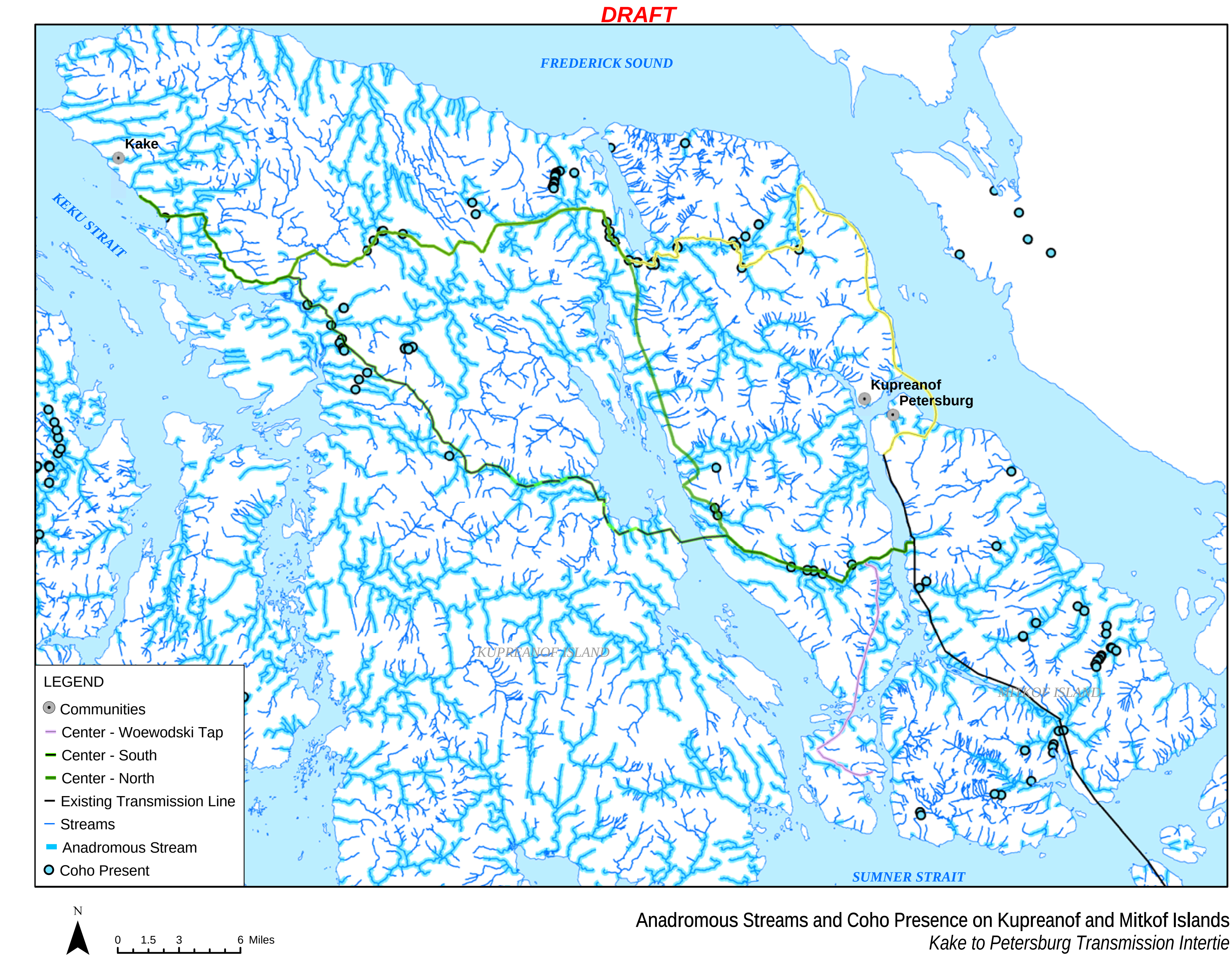


Land Use Designations and Wilderness Boundary on Kupreanof and Mitkof Islands

Kake to Petersburg Transmission Intertie

FIGURE 3-3



Anadromous Streams and Coho Presence on Kupreanof and Mitkof Islands

Kake to Petersburg Transmission Intertie

FIGURE 3-4

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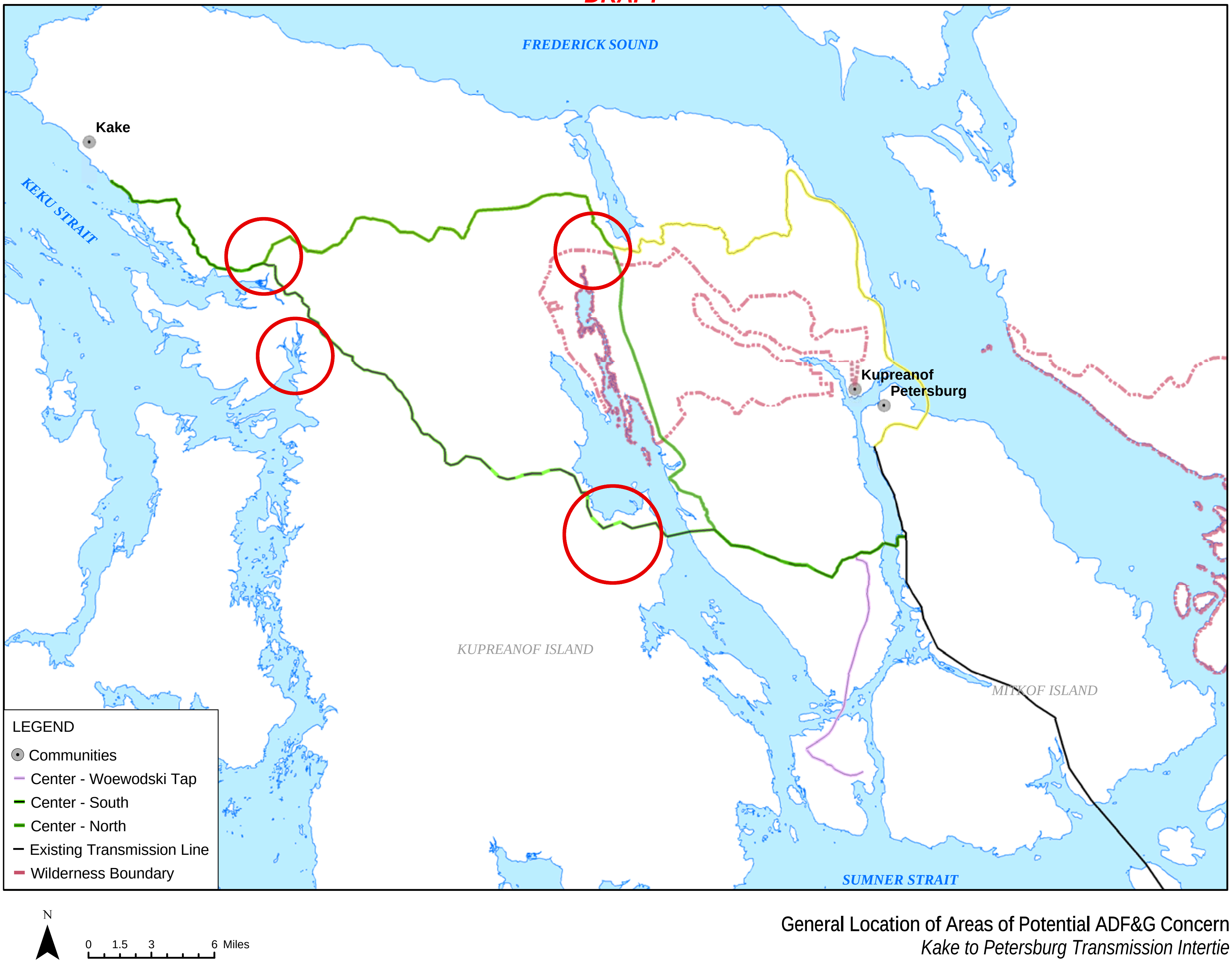

General Location of Areas of Potential ADF&G Concern

Kake to Petersburg Transmission Intertie

FIGURE 3-5

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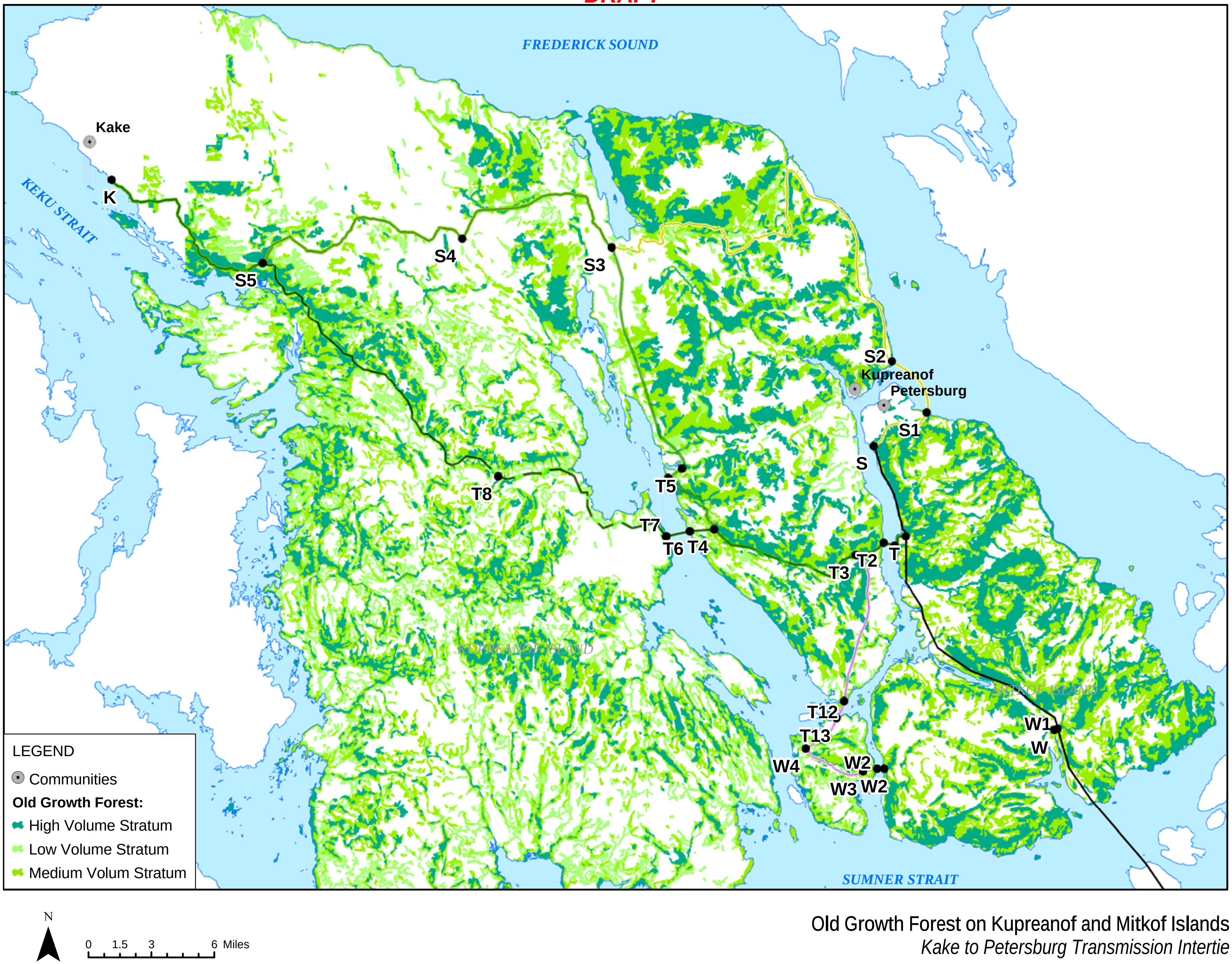


Old Growth Forest on Kupreanof and Mitkof Islands

Kake to Petersburg Transmission Intertie

FIGURE 3-6

Estimated Costs of Construction

Introduction

The costs to develop and construct the KPTL have been estimated for each of the four primary route alternatives. The cost estimate is based on an estimate of the required material quantities as determined from a preliminary design[11] of the overhead sections of the line, planned submarine cable configurations, and substation and switchyard requirements. Labor costs have been estimated based on recent experience on similar projects as well as discussions with individuals familiar with transmission line construction in Southeast Alaska. The estimated unit costs of materials are based on quotes from vendors and recent experience with similar construction projects.

The estimated costs of the KPTL alternatives as provided in this section of the report include all estimated costs of engineering and design, permitting, materials, equipment and construction. Primary components of each line (e.g. overhead lines, submarine cables) are identified separately in the cost estimate. Since the design of the KPTL is still preliminary, a contingency factor of 15% has been applied to all costs. As design proceeds and more precision can be used in estimating the costs, the contingency included in the total cost estimate can possibly be lowered. In any major project of this type, however, the actual cost of construction can very significantly from the engineer’s estimate due to market conditions for the materials and services needed at the time of procurement. As an example, the labor cost of high voltage lineworkers is very high at the present time due to extensive demand for such services around the country. Metal prices are also very high at the present time.

The cost estimates included in this report are based on the routing and technical information described in Section 2. Primary characteristics of the line are 69-kV, single-pole construction alongside existing roads where available. A 24 strand fiber-optic communication line is included along the entire length of all alternatives. Submarine crossings are to be made with single 3-phase, 4/0 copper dielectric cables with a single layer outer shield and steel armor. The 24 strand fiber-optic communication line is to be bundled in to the cable. It is expected that KWETICO, the owner of the transmission lines, will contract for all services of permitting, design, construction and construction management. The estimated costs of these services are included in the total cost estimate.

In addition to the estimated direct costs of construction, indirect cost items have also been estimated. Included among the indirect costs are the estimated costs of permitting, engineering, surveys, structure staking, owner’s administration, construction management and contingencies. For the purpose of this estimate, the owner’s administration cost is assumed to be 5% of the total direct costs and the construction management cost is assumed to be 5% of the total direct cost.

[11] A preliminary design of the overhead transmission system was prepared using PLS-CADD design software. The PLS-CADD software determines the placement of transmission structures and the type of structures needed (tangent, small angle, light angle, medium angle and deadend). From this preliminary design the required material quantities have been derived. The PLS-CADD graphical layout drawings for the Center-South alternative are provided in Appendix C.

The estimated cost of permitting is based on the costs shown in Section 3 of this report. The assumed contingency amount of 15% has been applied to all direct and indirect costs.

The cost estimate for each route alternative includes the estimated cost of constructing an access road along the transmission line route in areas where logging roads do not exist. For the Center-North Alternative that traverses the Wilderness Area, a smaller, access trail will be constructed. Clearing of trees and brush will be needed along the right of way for each route, however, in areas where the line will be built along existing roads, the clearing requirement will be greatly reduced. The estimated cost of clearing is $9,000 per acre, assuming the sale of merchantable timber. For the Northern Alternative where the amount of merchantable timber is estimated to be greater, the cost of clearing is estimated to be $6,000 per acre[12].

The estimated cost of access road construction is $165,000 per mile in forested areas and $190,000 per mile in muskeg areas. This cost includes clearing of a 60 foot-wide right-of-way, a total 14 foot-wide road with a 10-12 foot-wide gravel covered surface and a road bedding made with typar or filter fabric. The estimated cost of access trail construction is $85,000 per mile in forested areas and $110,000 per mile in muskeg areas. The total area to be cleared and the length of road and trail construction for each route alternative are shown in the following table.

TABLE 4-1
Estimated Right-of-Way Clearing and Road Construction Requirements and Costs

	Route Alternative				
	Center - South	Center - North	Northern	Southern Woewodski	Woewodski Tap
Area to be Cleared (acres)	90	77	236	180	26
Access Road Construction (miles)					
Forested Area	5.7	5.7	13.0	10.7	1.8
Muskeg Area	7.5	2.0	9.3	13.8	3.7
Total	13.2	7.7	22.3	24.5	5.5
Access Trail Construction (miles)					
Forested Area	-	4.7	-	-	-
Muskeg Area	-	6.7	-	-	-
Total	-	11.4	-	-	-
Estimated Clearing and Road/Trail Construction Costs ($000)					
Clearing	$ 810	$ 693	$ 1,416	$ 1,620	$ 234
Access Road/Trail Construction					
Forested Areas	941	1,341	2,730	1,766	297
Muskeg Areas	1,425	1,117	1,767	2,622	703
Total	$ 3,176	$ 3,151	$ 5,913	$ 6,008	$ 1,234

It should be noted that the Woewodski Tap Alternative is a relatively short length of line that taps either the Center-North or Center-South route at a point just west of Wrangell Narrows and

[12] Specific estimates for the value of merchantable timber are very preliminary at this point. The value of timber to be removed from the right of way is subject to market conditions at the time of removal. Depending on the market conditions, it may be more cost effective to leave timber along the side of the right of way rather than remove it.

will deliver power to a potential mining facility on Woewodski Island. The Woewodski Tap Alternative does not provide a transmission connection between Kake and Petersburg.

The estimated total costs for each alternative are summarized in the following table.

TABLE 4-2
Estimated Comparable Costs of Development and Construction for Each Route
($000)

	Route Alternative				
	Center - South	Center - North	Northern	Southern Woewodski	Woewodski Tap
Overhead Line	$ 14,225	$ 18,903	$ 17,257	$ 21,145	$ 2,237
Clearing and Road Construction	3,176	3,151	5,913	6,008	1,234
Submarine Cables	3,696	1,891	4,515	3,397	2,347
Switchyards and Substations	1,340	1,340	1,340	1,340	150
Subtotal - Direct Costs	$ 22,437	$ 25,285	$ 29,025	$ 31,890	$ 5,968
Indirect Costs	$ 3,839	$ 4,546	$ 4,603	$ 4,891	$ 1,256
Contingency (15%)	3,941	4,475	5,044	5,517	1,084
Total Costs	$ 30,217	$ 34,306	$ 38,672	$ 42,298	$ 8,308

As shown in Table 4-2, the lowest cost alternative is the Center-South Alternative while the highest cost alternative is the Southern Woewodski Alternative. The estimated cost of the Center-South Alternative shown in Table 4-2 is approximately 30% higher than the estimated cost of the Southern Alternative as provided in the 2003 Intertie Study[13]. Reasons for the higher estimated cost in this study are the inclusion of constructing access roads, much higher material and freight costs, higher labor costs and the inclusion of explicit construction camp costs.

The Woewodski Tap Alternative, which is only a spur line to interconnect the Center-South or Center-North Alternative to a potential mining facility on Woewodski Island includes the cost of building an overhead line on Woewodski Island to the expected site of mine processing and ore handling equipment. The cost estimate for this alternative does not include the cost of a substation on the island, however. The cost of a substation would be expected to be borne by the mine itself.

Detailed cost estimates for the route alternatives are shown in the following tables.

[13] The Center-South Route in this study is the same as the Southern Route from the 2003 Intertie Study. The estimated cost of the Southern Route alternative in the 2003 Intertie Study was $23,073,700.

TABLE 4-3 (Page 1 of 2)
Estimated Cost of Project Development and Construction
Kake - Petersburg Transmission Line

Center-South Alternative

	Estimated Cost
Overhead Line	
Material and Freight	
Poles	$ 1,828,000
Conductor	850,000
Insulators	352,000
Guys and Hardware	290,000
Fiber Optic Cable (ADSS 24 Strand)	565,000
Other	-
Subtotal - Materials	$ 3,885,000
Labor	$ 6,870,000
Incidental and Other Direct Costs	
Camp Cost	$ 770,000
Rockdrills and Blasting Materials	350,000
Equipment and Tools	559,000
Fuel and Maintenance	580,000
Barge and Landing Craft	150,000
Air Transportation	70,000
Helicopter Use	281,000
Mobilization and Demobilization	410,000
Bond and Insurance	300,000
Subtotal - Incidental and Other Direct Costs	$ 3,470,000
Subtotal - Overhead Line	$ 14,225,000
Clearing and Road Construction	
Clearing with Timber Credit	$ 810,000
Road Construction - Forested Areas	941,000
Road Construction - Muskeg Areas	1,425,000
Subtotal	$ 3,176,000
Submarine Cable - Wrangell Narrows T1-T2	
Cable - 3-4/0 copper bundled, 69-kV, 24 fiber strands	$ 355,000
Outer Armor Cable Shell	45,000
Installation	251,000
Marine Survey	60,000
Engineering	40,000
Mob/Demob	900,000
Termination Facilities	240,000
Subtotal	$ 1,891,000
Submarine Cable - Duncan Canal T6-T7	
Cable - 3-4/0 copper bundled, 69-kV, 24 fiber strands	$ 689,000
Outer Armor Cable Shell	45,000
Installation	521,000
Marine Survey	65,000
Engineering	45,000
Mob/Demob	200,000
Termination Facilities	240,000
Subtotal	$ 1,805,000

TABLE 4-3 (Page 2 of 2)
Estimated Cost of Project Development and Construction
Kake - Petersburg Transmission Line

Center-South Alternative

Petersburg Tap Switchyard		
Civil Site Prep & Foundations	$	90,000
Ground Grid and Fencing		42,000
Bus Works		42,000
Control Cable and Conduit		44,000
SCADA and Control Interface		40,000
Sectionalizing Switch (2)		85,000
Breaker & CT		92,000
Relaying, PT		48,000
Revenue Metering		46,000
Shunt Reactor and Disc SW		-
Subtotal	$	529,000
Kake Substation		
Civil Site Prep & Foundations	$	135,000
Ground Grid and Fencing		42,000
Bus Works		34,000
Control Cable and Conduit		36,000
SCADA and Control Interface		40,000
Fuses/Switches		40,000
Transformer -69/12.5-kV, 2.5 MVA, Relaying, LA, etc.		210,000
Voltage Regulators/Bypass Switches		34,000
Recloser/Disconnect Switch		34,000
Relaying PT		36,000
Installation Labor		40,000
Station Service and Battery		130,000
Subtotal	$	811,000
Total Direct Costs	$	22,437,000
Indirect Costs		
Alignment Survey	$	125,000
Final Engineering		600,000
Permitting		655,000
Structure Staking		125,000
Geotechnical Surveys		90,000
Construction Management (5% of Direct Costs)		1,122,000
Owners Administration (5% of Direct Costs)		1,122,000
Subtotal - Indirect Costs	$	3,839,000
Contingency - 15%		3,941,000
Total Project Cost	$	30,217,000

TABLE 4-4 (Page 1 of 2)
Estimated Cost of Project Development and Construction
Kake - Petersburg Transmission Line

Center-North Alternative

	Estimated Cost
Overhead Line	
Material and Freight	
Poles	$ 2,583,000
Conductor	995,000
Insulators	497,000
Guys and Hardware	410,000
Fiber Optic Cable (ADSS 24 Strand)	661,000
Other	-
Subtotal - Materials	$ 5,146,000
Labor	$ 9,708,000
Incidental and Other Direct Costs	
Camp Cost	$ 1,088,000
Rockdrills and Blasting Materials	350,000
Equipment and Tools	790,000
Fuel and Maintenance	610,000
Barge and Landing Craft	150,000
Air Transportation	70,000
Helicopter Use	281,000
Mobilization and Demobilization	410,000
Bond and Insurance	300,000
Subtotal - Incidental and Other Direct Costs	$ 4,049,000
Subtotal - Overhead Line	$ 18,903,000
Clearing and Road Construction	
Clearing with Timber Credit	$ 693,000
Road Construction - Forested Areas	941,000
Road Construction - Muskeg Areas	380,000
Trail Construction - Forested Wilderness	400,000
Trail Construction - Muskeg Wilderness	737,000
Subtotal	$ 3,151,000
Submarine Cable - Wrangell Narrows T1-T2	
Cable - 3-4/0 copper bundled, 69-kV, 24 fiber strands	$ 355,000
Outer Armor Cable Shell	45,000
Installation	251,000
Marine Survey	60,000
Engineering	40,000
Mob/Demob	900,000
Termination Facilities	240,000
Subtotal	$ 1,891,000

TABLE 4-4 (Page 2 of 2)
Estimated Cost of Project Development and Construction
Kake - Petersburg Transmission Line

Center-North Alternative

Petersburg Tap Switchyard		
Civil Site Prep & Foundations	$	90,000
Ground Grid and Fencing		42,000
Bus Works		42,000
Control Cable and Conduit		44,000
SCADA and Control Interface		40,000
Sectionalizing Switch (2)		85,000
Breaker & CT		92,000
Relaying, PT		48,000
Revenue Metering		46,000
Shunt Reactor and Disc SW		-
Subtotal	$	529,000
Kake Substation		
Civil Site Prep & Foundations	$	135,000
Ground Grid and Fencing		42,000
Bus Works		34,000
Control Cable and Conduit		36,000
SCADA and Control Interface		40,000
Fuses/Switches		40,000
Transformer -69/12.5-kV, 2.5 MVA, Relaying, LA, etc.		210,000
Voltage Regulators/Bypass Switches		34,000
Recloser/Disconnect Switch		34,000
Relaying PT		36,000
Installation Labor		40,000
Station Service and Battery		130,000
Subtotal	$	811,000
Total Direct Costs	$	25,285,000
Indirect Costs		
Alignment Survey	$	125,000
Final Engineering		600,000
Permitting		1,078,000
Structure Staking		125,000
Geotechnical Surveys		90,000
Construction Management (5% of Direct Costs)		1,264,000
Owners Administration (5% of Direct Costs)		1,264,000
Subtotal - Indirect Costs	$	4,546,000
Contingency - 15%		4,475,000
Total Project Cost	$	34,306,000

TABLE 4-5 (Page 1 of 2)
Estimated Cost of Project Development and Construction
Kake - Petersburg Transmission Line

Northern Alternative

	Estimated Cost
Overhead Line	
Material and Freight	
Poles	$ 2,340,000
Conductor	901,000
Insulators	454,000
Guys and Hardware	371,000
Fiber Optic Cable (ADSS 24 Strand)	599,000
Other	-
Subtotal - Materials	$ 4,665,000
Labor	$ 8,794,000
Incidental and Other Direct Costs	
Camp Cost	$ 986,000
Rockdrills and Blasting Materials	371,000
Equipment and Tools	615,000
Fuel and Maintenance	615,000
Barge and Landing Craft	150,000
Air Transportation	70,000
Helicopter Use	281,000
Mobilization and Demobilization	410,000
Bond and Insurance	300,000
Subtotal - Incidental and Other Direct Costs	$ 3,798,000
Subtotal - Overhead Line	$ 17,257,000
Clearing and Road Construction	
Clearing with Timber Credit	$ 1,416,000
Road Construction - Forested Areas	2,730,000
Road Construction - Muskeg Areas	1,767,000
Subtotal	$ 5,913,000
Submarine Cable - Wrangell Narrows S1-S2	
Cable - 3-4/0 copper bundled, 69-kV, 24 fiber strands	$ 1,914,000
Outer Armor Cable Shell	68,000
Installation	1,226,000
Marine Survey	87,000
Engineering	80,000
Mob/Demob	900,000
Termination Facilities	240,000
Subtotal	$ 4,515,000

TABLE 4-5 (Page 2 of 2)
Estimated Cost of Project Development and Construction
Kake - Petersburg Transmission Line

Northern Alternative

Petersburg Tap Switchyard		
Civil Site Prep & Foundations	$	90,000
Ground Grid and Fencing		42,000
Bus Works		42,000
Control Cable and Conduit		44,000
SCADA and Control Interface		40,000
Sectionalizing Switch (2)		85,000
Breaker & CT		92,000
Relaying, PT		48,000
Revenue Metering		46,000
Shunt Reactor and Disc SW		-
Subtotal	$	529,000
Kake Substation		
Civil Site Prep & Foundations	$	135,000
Ground Grid and Fencing		42,000
Bus Works		34,000
Control Cable and Conduit		36,000
SCADA and Control Interface		40,000
Fuses/Switches		40,000
Transformer -69/12.5-kV, 2.5 MVA, Relaying, LA, etc.		210,000
Voltage Regulators/Bypass Switches		34,000
Recloser/Disconnect Switch		34,000
Relaying PT		36,000
Installation Labor		40,000
Station Service and Battery		130,000
Subtotal	$	811,000
Total Direct Costs	$	29,025,000
Indirect Costs		
Alignment Survey	$	125,000
Final Engineering		600,000
Permitting		761,000
Structure Staking		125,000
Geotechnical Surveys		90,000
Construction Management (5% of Direct Costs)		1,451,000
Owners Administration (5% of Direct Costs)		1,451,000
Subtotal - Indirect Costs	$	4,603,000
Contingency - 15%		5,044,000
Total Project Cost	$	38,672,000

TABLE 4-6 (Page 1 of 2)
Estimated Cost of Project Development and Construction
Kake - Petersburg Transmission Line

Southern Woewodski Alternative

	Estimated Cost
Overhead Line	
Material and Freight	
Poles	$ 2,718,000
Conductor	1,487,000
Insulators	523,000
Guys and Hardware	431,000
Fiber Optic Cable (ADSS 24 Strand)	840,000
Other	-
Subtotal - Materials	$ 5,999,000
Labor	$ 10,215,000
Incidental and Other Direct Costs	
Camp Cost	$ 1,145,000
Rockdrills and Blasting Materials	520,000
Equipment and Tools	1,004,000
Fuel and Maintenance	862,000
Barge and Landing Craft	150,000
Air Transportation	100,000
Helicopter Use	300,000
Mobilization and Demobilization	450,000
Bond and Insurance	400,000
Subtotal - Incidental and Other Direct Costs	$ 4,931,000
Subtotal - Overhead Line	$ 21,145,000
Clearing and Road Construction	
Clearing with Timber Credit	$ 1,620,000
Road Construction - Forested Areas	1,766,000
Road Construction - Muskeg Areas	2,622,000
Subtotal	$ 6,008,000
Submarine Cable - Wrangell Narrows W2-W3	$ 1,592,000
Submarine Cable - Duncan Canal W5-W6	$ 1,805,000

TABLE 4-6 (Page 2 of 2)
Estimated Cost of Project Development and Construction
Kake - Petersburg Transmission Line

Southern Woewodski Alternative

South Mitkof Tap Switchyard		
Civil Site Prep & Foundations	$	90,000
Ground Grid and Fencing		42,000
Bus Works		42,000
Control Cable and Conduit		44,000
SCADA and Control Interface		40,000
Sectionalizing Switch (2)		85,000
Breaker & CT		92,000
Relaying, PT		48,000
Revenue Metering		46,000
Shunt Reactor and Disc SW		-
Subtotal	$	529,000
Kake Substation		
Civil Site Prep & Foundations	$	135,000
Ground Grid and Fencing		42,000
Bus Works		34,000
Control Cable and Conduit		36,000
SCADA and Control Interface		40,000
Fuses/Switches		40,000
Transformer -69/12.5-kV, 2.5 MVA, Relaying, LA, etc.		210,000
Voltage Regulators/Bypass Switches		34,000
Recloser/Disconnect Switch		34,000
Relaying PT		36,000
Installation Labor		40,000
Station Service and Battery		130,000
Subtotal	$	811,000
Total Direct Costs	$	31,890,000
Indirect Costs		
Alignment Survey	$	125,000
Final Engineering		600,000
Permitting		761,000
Structure Staking		125,000
Geotechnical Surveys		90,000
Construction Management (5% of Direct Costs)		1,595,000
Owners Administration (5% of Direct Costs)		1,595,000
Subtotal - Indirect Costs	$	4,891,000
Contingency - 15%		5,517,000
Total Project Cost	$	42,298,000

TABLE 4-7 (Page 1 of 2)
Estimated Cost of Project Development and Construction
Kake - Petersburg Transmission Line

Woewodski Tap Alternative

	Estimated Cost
Overhead Line	
Material and Freight	
Poles	$ 277,000
Conductor	129,000
Insulators	52,000
Guys and Hardware	44,000
Fiber Optic Cable (ADSS 24 Strand)	86,000
Other	-
Subtotal - Materials	$ 588,000
Labor	$ 1,042,000
Incidental and Other Direct Costs	
Camp Cost	$ 142,000
Rockdrills and Blasting Materials	53,000
Equipment and Tools	85,000
Fuel and Maintenance	104,000
Barge and Landing Craft	27,000
Air Transportation	18,000
Helicopter Use	59,000
Mobilization and Demobilization	73,000
Bond and Insurance	46,000
Subtotal - Incidental and Other Direct Costs	$ 607,000
Subtotal - Overhead Line	$ 2,237,000
Clearing and Road Construction	
Clearing with Timber Credit	$ 234,000
Road Construction - Forested Areas	297,000
Road Construction - Muskeg Areas	703,000
Subtotal	$ 1,234,000
Submarine Cable - Wrangell Narrows T12-T13	
Cable - 3-4/0 copper bundled, 69-kV, 24 fiber strands	$ 556,000
Outer Armor Cable Shell	45,000
Installation	506,000
Marine Survey	60,000
Engineering	40,000
Mob/Demob	900,000
Termination Facilities	240,000
Subtotal	$ 2,347,000
Interconnection at T3 (Load Break Switch)	$ 150,000

TABLE 4-7 (Page 2 of 2)
Estimated Cost of Project Development and Construction
Kake - Petersburg Transmission Line

Woewodski Tap Alternative

Mine Substation	
Civil Site Prep & Foundations	$ -
Ground Grid and Fencing	-
Bus Works	-
Control Cable and Conduit	-
SCADA and Control Interface	-
Fuses/Switches	-
Transformer	-
Voltage Regulators/Bypass Switches	-
Recloser/Disconnect Switch	-
Relaying PT	-
Installation Labor	-
Station Service and Battery	-
Subtotal	$ -
Total Direct Costs	$ 5,968,000
Indirect Costs	
Alignment Survey	$ 45,000
Final Engineering	150,000
Permitting	400,000
Structure Staking	35,000
Geotechnical Surveys	30,000
Construction Management (5% of Direct Costs)	298,000
Owners Administration (5% of Direct Costs)	298,000
Subtotal - Indirect Costs	$ 1,256,000
Contingency - 15%	1,084,000
Total Project Cost	$ 8,308,000

Example Project Development Schedule

Introduction

The KPTL construction cost estimates provided in Section 4 include the estimated costs of several activities prior to actual construction. Included among these activities are preliminary design, geotechnical surveys, permitting and environmental studies, and final design. The actual time required to perform these activities and when they would be performed will depend on a number of factors. An example development schedule has been prepared to indicate what activities would be performed and what the activity duration would be for development of the KPTL.

An integral part of the development of any project requiring a significant degree of grant funding is the pursuit and approval of funding sources. The time required for this effort cannot be reliably predicted. In addition, there will be a number of permits and approvals needed to construct the Interties as indicated in Section 3 of this report. The time required to obtain the necessary permits is often influenced by the degree of public support or opposition to the projects. Further, various commercial arrangements will be needed to allow for the effective utilization of the Interties. Such arrangements would include power sales agreements and contracts.

Permitting and Environmental Studies

The preparation of certain information needed in the permitting process, such as route diagrams and technical descriptions, will necessitate that certain engineering work be accomplished fairly early in the process. The expected duration of permitting activities for the KPTL is approximately two years. In order to expedite the development process, it would be recommended that preliminary engineering and route alignment activities be conducted concurrently with early permitting work and environmental studies.

Engineering Related Activities

The project development approach outlined below is based upon construction being undertaken by a contractor(s) using plans and technical specifications prepared by an engineering firm experienced with overhead transmission line design. Major equipment and materials would be obtained by KWETICO with installation performed by a construction contractor. An engineering firm, working as the Owner's Project Engineer would manage and oversee specialty engineering services. Various activities related to the engineering function of project development are described in the following paragraphs.

Selection of Project Team

Typically owners select a Project Manager (with appropriate experience) and contract with specialty firms to provide the required services. Engineering and related specialty areas include:

- Project Management
- Preliminary and Final Engineering
- Engineering survey
- Geotechnical Investigations
- Easements, Land Rights, property survey
- Logging and Clearing Specialist
- Construction Specialist

The engineering team would be charged with developing and implementing a detailed work plan, schedule and budget to accomplish the Project on schedule and within budget.

Alignment Definition

One of the first tasks required to move the Project forward will be to refine the conceptual design and the selected route. Construction, operation and maintenance issues will be discussed in detail with the owner and the owner's operating personnel to identify project requirements.

During this phase a transmission line design engineer and other specialists would initiate a detailed review of the route identifying any routing concerns or route improvements. This work will require coordination with the environmental and permitting specialist knowledgeable with the area. Incorporating input from the various specialists, a specific alignment will be selected. Selection of the specific alignment will consider:

- Specific site locations of Tap, Substation, Submarine Crossings
- Alignment of logging road
- Location of clear-cuts, size of trees
- Location of Muskeg
- Terrain elevation differences
- Environmental or cultural avoidance areas
- Location of eagle trees
- Location of good soils for structure stability
- Visual Concerns

Engineering Survey

An engineering survey will be obtained once a specific alignment is identified in the field and tied down with specific coordinates. The engineering survey will locate physical features in plan and determine elevations along the alignment within the defined corridor. Plan/profile drawings will be developed from the field survey.

There are several types of surveying methods which could be utilized on a project such as the Interties. One which may prove economical while also providing great flexibility in allowing adjustments during preliminary design without requiring follow-up visits for additional surveys is LIDAR (Light Detection and Ranging).

LIDAR, in summary, uses a laser and receivers mounted generally on a helicopter to scan an area from low altitude and collect survey data. The helicopter has airborne global positioning system (GPS) capability and also ties into ground stations established at about every 25 mile radius. The laser sends out several thousand pulses per second and the returns are collected by the receivers mounted on outriggers.

The data is collected as a series of X,Y,Z points tied to a reference grid such as State Plain Coordinates. The huge amount of data collected in the field is filtered and reduced into separate files such as ground, existing structures, existing wires and vegetation. These files can then be imported into design programs such as PLS-Cadd. In PLS-Cadd, the designer can create a surface wire-frame model from which profiles can be cut once the alignment is established. Because of the very dense coverage, (points are separated by a couple of feet within a 200′ to 1,000′ wide corridor) the surface model will result in very precise profiles. Refinements may be made to enhance the alignment following a review of the plan/profile drawings.

Preliminary Engineering

Much of the preliminary engineering work needed for the KPTL has been accomplished as part of this study. The objective of the preliminary design task is to finalize design criteria and to complete sufficient design calculations to determine the general layout and sizing of major facility components. Preliminary engineering will proceed simultaneously with the alignment definition phase. The preliminary design phase will include additional system studies and discussions with the owner's operating personnel to refine and determine:

- System protection plan
- 1-lines of system
- Equipment and conductor sizes
- Voltage drop and power flow
- Appropriate insulation
- Need for reactors

Preliminary engineering will also determine all of the detail design parameters and will result in issuance of a Basis of Design documenting design requirements such as:

- Codes and Standards
- Clearance requirements (horizontal and vertical)
- Conductor tension limits
- Sag/tension data
- Physical loading requirements
- Overload capacity factors
- Grounding requirements

- Clearing requirements
- Right-of-way constraints
- Framing requirements
- Guy and anchor requirements

Geotechnical Investigations

Subsurface soils investigations will be required at the major equipment locations (substation, termination locations and tap points). Experienced geotechnical personnel will review the entire route and observe road cuts and perform excavation of test pits along the route. Using the data collected tempered with experience, a subsurface profile will be developed identifying the subsurface profile and key avoidance areas.

Final Design

Final design will involve the completion and documentation of design calculations, special analysis, development of construction drawings, development of construction and material specifications, and development of final material lists. During final design, specific pole locations, framing, pole size, guy leads and anchor types will be determined for each structure along the alignment. Locations will be staked and field reviewed. At the major equipment locations, structures, foundations, grounding, and fencing will be sized and designed as appropriate.

Initiate Construction and Material Procurement Contracts

This function would involve the preparation of bid documents and specifications for vendors and suppliers to base bids for materials and construction services. Much of the material needed for the overhead portions of the Intertie can be obtained relatively quickly. The submarine cables would require a longer lead time and in particular, delivery of the cables and arranging for installation could require more than a year. Flexibility in the schedule with regard to the cable procurement could significantly affect the delivered and installed cost of the cable.

In general, it is expected that the procurement of materials and construction services would be conducted through the solicitation of bids and award of contracts to vendors and contractors early in the year in which construction is expected to commence. The first year of construction activity is not expected to require significant material deliveries so a full year of lead time on material manufacturing and delivery would be allowed for in the schedule.

Construction Activities

A two-year construction duration is expected for the KPTL. The major activities to be undertaken in each year are as follows:

Year 1

- Alignment clearing
- Construction of work pads, as required
- Construction of other key components, as appropriate

Year 2

- Line construction
- Installation of submarine cables
- Substation and switchyard construction

The actual time required to install the submarine cables is quite short, possibly just a few days. As such, they can be installed at anytime in the second year of the construction period, potentially at the very end of the process just before energization of the line.

Total Project Development Schedule

Assuming that funding were available, or at least reasonably assured, and arrangements needed to proceed with the KPTL were approved, it is estimated that a 3.5 to 4.0 year development and construction schedule could be accomplished for the KPTL.

Power Supply Evaluation and Economic Analysis

Power Supply Evaluation

Overview

Hydroelectric generating facilities and diesel generators provide nearly all of the electric power generation in Southeast Alaska[14]. Elsewhere in Alaska, natural gas and coal are used to provide a significant portion of the electrical power supply; however, these fuels are not commercially available in Southeast Alaska. The State and federal government, as well as certain communities and utilities have developed the existing hydroelectric generating plants in Southeast Alaska.

Hydroelectric facilities require specific site conditions and generally have high initial development costs. The effective costs of hydroelectric development can be made even higher by the need to construct projects larger than the present electric loads require. This can create a surplus energy generation capability from hydroelectric plants, sometimes for a significant length of time.

The availability of diesel fuel, the ease of installing diesel generators in a wide range of capacities and relatively low initial costs have made diesel engine generators the generator of choice in most remote locations including Southeast Alaska. The operating and maintenance (O&M) expenses associated with diesel generators, however, often make them more costly than hydroelectric generation plants in the long run. Potential interruptions in fuel delivery, the susceptibility of fuel prices to wide variation, noise and air pollution issues are other negative aspects of diesel generation. Where available, hydroelectric generation is typically preferred to diesel generation.

The primary purpose of the KPTL will be to transmit power generated at the Four Dam Pool Power Agency's Lake Tyee hydroelectric project to Kake where diesel generation is the only source of power supply. At the present time, significant additional hydroelectric energy capability is available at the Lake Tyee project. If a mining operation is established at Woewodski Island, the KPTL can be extended to permit power transmission to the mine. It is not known what arrangements would be made to supply power to the Woewodski mine, however, it is expected that power from the Lake Tyee project, to the extent available, would be sold to the mine. New hydroelectric projects could potentially be developed in the interconnected area. With the KPTL and the Swan-Tyee Intertie, a much larger regional power supply system would exist that would allow for better utilization of existing generating resources as well as encourage development of the most cost effective new hydroelectric facilities available in the region.

[14] In the past, pulp mills in Ketchikan and Sitka used production waste materials as a boiler fuel to drive steam turbines.

The electric power requirements of all the interconnected load centers involved with the KPTL are important to the evaluation of the KPTL feasibility. Projections of power requirements have been compiled for Kake, Petersburg, Wrangell, and Ketchikan, all of which currently rely upon the output of the Lake Tyee project or will be connected to Lake Tyee through the construction of new transmission facilities. Estimated power requirement projections have also been developed for the Woewodski mine, based on the estimated power requirements of the Kennecott Mining Company - Greens Creek Mine (KMC-GC) near Juneau.

The KPTL will be used to transmit hydroelectric energy that is either surplus to the needs of the interconnected Four Dam Pool members (Petersburg, Wrangell and Ketchikan) or from interconnected hydroelectric plants to be built in the future[15]. Consequently, it is important to evaluate the availability of the surplus generation and identify potential new hydroelectric resources that can be developed to economically provide additional energy to the interconnected systems, as needed, in the future. Although transmission lines are generally very reliable, power deliveries over the KPTL will need to be considered interruptible. As such, local generation sufficient to supply loads if the transmission lines are down due to unplanned outages or maintenance will continue to be needed in Kake and at the Woewodski mine.

It is also important to note the commercial and contractual arrangements that are in place that could potentially limit the availability of power resources for sale to other utility systems. For example, the Lake Tyee project is owned and operated by the FDPPA and its output is sold to Petersburg and Wrangell pursuant to the Four Dam Pool Power Sales Agreement. Petersburg, Wrangell and eventually Ketchikan when it is interconnected, will always have first priority to the output of the Lake Tyee Project pursuant to the Power Sales Agreement.

Power Requirements

Electric power requirements have been projected for KPTL interconnected utilities for a ten-year projection period. For Kake, the power requirement projections are based on assumed growth rates applied to recently experienced loads. Power requirements for Ketchikan, Petersburg and Wrangell have been compiled from previously prepared Four Dam Pool planning studies. As previously indicated, the power requirements for the Woewodski mine have been estimated based on representative power requirements of the KMC-GC mine. The existing loads of the utilities are shown in Table 6-1.

[15] Other existing hydroelectric facilities used to supply power to Petersburg and Ketchikan are fully utilized.

TABLE 6-1
2003 Energy Loads (MWh) [1]

	Energy Sales (MWh)				
	Firm	Non-Firm [2]	Total	Energy Reqs. [3] (MWh)	Peak (kW)
Petersburg	36,063	-	36,063	40,803	8,010
Wrangell	19,299	3,169	22,468	23,541	3,670
Ketchikan	145,121	-	145,121	154,730	27,600
IPEC - Kake	2,051	474	2,526	2,877	684

[1] Data shown for Kake is for 2004..

[2] Non-firm, or interruptible energy sales can be curtailed under certain circumstances. Sales shown are to the Silver Bay sawmill in Wrangell.

[3] Energy requirements are the summation of total generation and total power purchases.

The basis for and assumptions used in preparing the projected power requirements for each of the load centers are described in the following paragraphs.

Petersburg and Wrangell

Petersburg and Wrangell are both municipally owned electric utilities interconnected with each other by the Lake Tyee transmission line.

Petersburg Municipal Power & Light

Petersburg Municipal Power & Light (PMPL) provides electric service to the residents and businesses of Petersburg and the surrounding area. In its fiscal year 2003, PMPL sold 36,063 MWh of electric energy to its 1,333 residential, 347 harbor, 284 small commercial, and 30 large commercial electric customers. Energy sales to a large seafood processing facility in Petersburg represented approximately 15 percent of PMPL's total energy sales in 2003. Total revenues from sales of electricity in 2003 were $3,989,602 representing average unit revenues of 11.06 cents per kWh. The total system peak demand was 8.01 MW and total energy requirements were 40,803 MWh in 2003.

PMPL owns and operates the 2.0 MW Blind Slough hydroelectric project with an average annual energy generation capability of approximately 11,500 MWh. PMPL fully utilizes the output of its own hydroelectric facility each year and purchases power from Lake Tyee to supply its remaining power supply requirement. PMPL has 6.6 MW of reliable diesel generation capacity[16]. Diesel generation is the most costly of PMPL's power supply resources and is typically only needed when the Lake Tyee project is unavailable due to maintenance or repair activities.

[16] Although PMPL has 10.1 MW of installed capacity at its diesel powerplant, 3.5 MW of this capacity is in poor condition and unreliable.

Total PMPL energy requirements in the past few years have remained relatively steady although some decrease has been seen since 2001. In the near future, total energy requirements are forecasted to increase slightly at an average annual growth rate of 0.5 percent for the medium growth rate scenario. Contributing to near term load growth is a large, electrically-heated community swimming pool that will become operational in 2006.

Wrangell Municipal Light & Power

Wrangell Municipal Light & Power (WMLP) provides electric service to the residents and businesses of Wrangell and the surrounding area. In its fiscal year 2003, WMLP sold 19,299 MWh of electric energy to its 1,050 residential, 481 small commercial, four large commercial, one industrial and one municipal electric customers. An additional 3,169 MWh of interruptible energy was sold to the Silver Bay sawmill in 2003, WMLP's largest electric customer. Total energy sales to the sawmill represented approximately 14.4 percent of WMLP's total energy sales in 2003. The combined energy requirements of two seafood processors represented another 9.5 percent of WMLP's total energy sales in 2003.

Total revenues from sales of electricity in 2003 were $2,229,341, excluding revenues from interruptible sales, representing average unit revenue of 11.55 cents per kWh. Energy sold by WMLP to the sawmill is purchased from the Four Dam Pool Power Agency at a reduced, interruptible rate. The total system peak demand was 3.67 MW and total energy requirements were 23,542 MWh in 2003.

WMLP owns and operates 8.4 MW of diesel generation capacity. Typically, WMLP supplies its entire power supply requirement from the Lake Tyee project although some diesel generation is used when the Lake Tyee project is unavailable due to maintenance or repair activities. WMLP and PMPL purchase power from Lake Tyee through the Four Dam Pool Power Agency.

Total WMLP energy requirements in the past few years have remained relatively steady although some decrease has been seen since 2001. In the near future, total energy requirements, net of interruptible energy sales, are forecasted to increase slightly in 2004 and remain constant for the remainder of the forecast period. Although the Silver Bay sawmill is presently operating, its continued operation is uncertain and no interruptible power sales to the sawmill are included in the forecast of WMLP energy sales for fiscal years 2005 and beyond.

Forecasted Power Requirements

Electric loads in Petersburg and Wrangell have been projected recently with regard to studies of the Tyee-Swan Intertie. Loads in Petersburg are assumed to increase at average annual rates of 0.5%, 0.0% and 2.0% for medium, low and high forecast scenarios, respectively. Loads in Wrangell are assumed to increase at average annual rates of 0.5%, 0.0% and 1.0% for medium, low and high forecast scenarios, respectively. In the medium and low load growth scenarios no energy sales are assumed to be made to the sawmill in Wrangell. For the high growth scenario, it is assumed that energy sales to the sawmill will be 5,000 MWh per year.

Forecasted loads for Wrangell and Petersburg are summarized in the following table.

TABLE 6-2
Petersburg and Wrangell
Projected Energy Requirements – Medium Growth Scenario

	2005	2006	2007	2008	2009	2014
Energy Requirements (MWh)						
Petersburg [1]	40,060	40,260	40,460	40,660	40,850	41,900
Wrangell [2]	20,480	20,580	20,690	20,790	20,900	21,420
Total	60,540	60,840	61,150	61,450	61,750	63,320
Less: Petersburg Hydro [3]	(11,000)	(11,000)	(11,000)	(11,000)	(11,000)	(11,000)
Less: Minimal Diesel [4]	(800)	(800)	(800)	(800)	(800)	(800)
Net Requirement on Tyee [5]	48,740	49,040	49,350	49,650	49,950	51,520

1 Assumes average growth in energy requirements of 0.5% per year.
2 Assumes average growth in energy requirements of 0.5% per year and continued closure of the sawmill.
3 Estimated average annual generation from PMP&L's Blind Slough hydroelectric project.
4 Estimated diesel generation needed for backup and maintenance purposes.
5 Projected net energy requirement of PMP&L and WML&P on the Lake Tyee hydroelectric project.

Ketchikan

Ketchikan Public Utilities (KPU), a municipally owned electric utility, is the second largest electric utility system in Southeast Alaska. KPU obtains the majority of its power supply from KPU-owned hydroelectric projects and the Swan Lake project, a Four Dam Pool Power Agency project. In most years, KPU's electric loads exceed the available hydroelectric generation capability and diesel generators must be used to supply the net power requirement. The FDPPA is presently constructing the Swan-Tyee Intertie to gain access to the surplus generation capability of the Lake Tyee project[17]. The electric requirements of KPU will affect the net generation available to Kake from the Lake Tyee project.

KPU provides electric and telephone service to the residents and businesses of Ketchikan and the surrounding Ketchikan Gateway Borough and provides water service within the city limits. In 2002, KPU sold 144,269 MWh of electric energy to its 5,625 residential, 1,051 commercial, 13 industrial and 482 other electric customers. Of the total energy sales in 2002, approximately 40 percent, 45 percent and 11.6 percent were to residential, commercial and industrial customers, respectively. Total revenues from sales of electricity in 2002 were $12,760,361 representing average unit revenues of 8.84 cents per kWh. The total system peak demand was 24.2 MW and total energy requirements were 154,700 MWh in 2002.

KPU owns and operates 11.7 MW of hydroelectric generating capacity at three separate facilities located relatively close to Ketchikan and 23.0 MW of diesel generation capacity located in its Bailey Powerplant. The average annual energy generation capability of the KPU-owned

[17] Construction of the Swan – Tyee Intertie began in 2004 but was discontinued later in the year pending acquisition of additional funding to complete the project. Neither the FDPPA nor the interconnected municipal utility systems can predict when or if construction will begin again. Approximately one more year of construction is needed to complete the project.

hydroelectric facilities is 68,460 MWh. In general, KPU fully utilizes the output of its own hydroelectric facilities each year and purchases power from Swan Lake to supply its remaining power supply requirement. Diesel generation, which is the most costly of KPU's power supply resources, is used as needed to supplement the output of the KPU hydroelectric facilities and Swan Lake.

With completion of the proposed Swan – Tyee Intertie, KPU will purchase power from the Lake Tyee project to supplant nearly all of its expected diesel generation in the near to mid future. Electric loads are assumed to increase at average annual rates of 0.7%, 0.2% and 2.0% for base, low and high forecast scenarios, respectively. KPU's forecasted electric requirements are summarized in the following table.

TABLE 6-3
Ketchikan Public Utilities
Projected Energy Requirements – Medium Growth Scenario

	2005	2006	2007	2008	2009	2014
Energy Requirements (MWh) [1]	155,990	157,080	158,180	159,290	160,400	166,090
Less: KPU Hydro [2]	(68,460)	(68,460)	(68,460)	(68,460)	(68,460)	(68,460)
Less: Swan Lake [3]	(69,000)	(69,000)	(69,000)	(69,000)	(69,000)	(69,000)
Net Requirement [4]	18,530	19,620	20,720	21,830	22,940	28,630

[1] Assumes average growth in energy requirements of 0.7% per year.
[2] Estimated annual energy generation from KPU-owned hydroelectric projects assuming average precipitation levels.
[3] Estimated annual generation from the Swan Lake hydroelectric project assuming average precipitation levels.
[4] Projected net energy requirement to be provided from diesel generation, new hydro project generation or the Lake Tyee hydroelectric project, assuming that construction of the Swan-Tyee Intertie is completed.

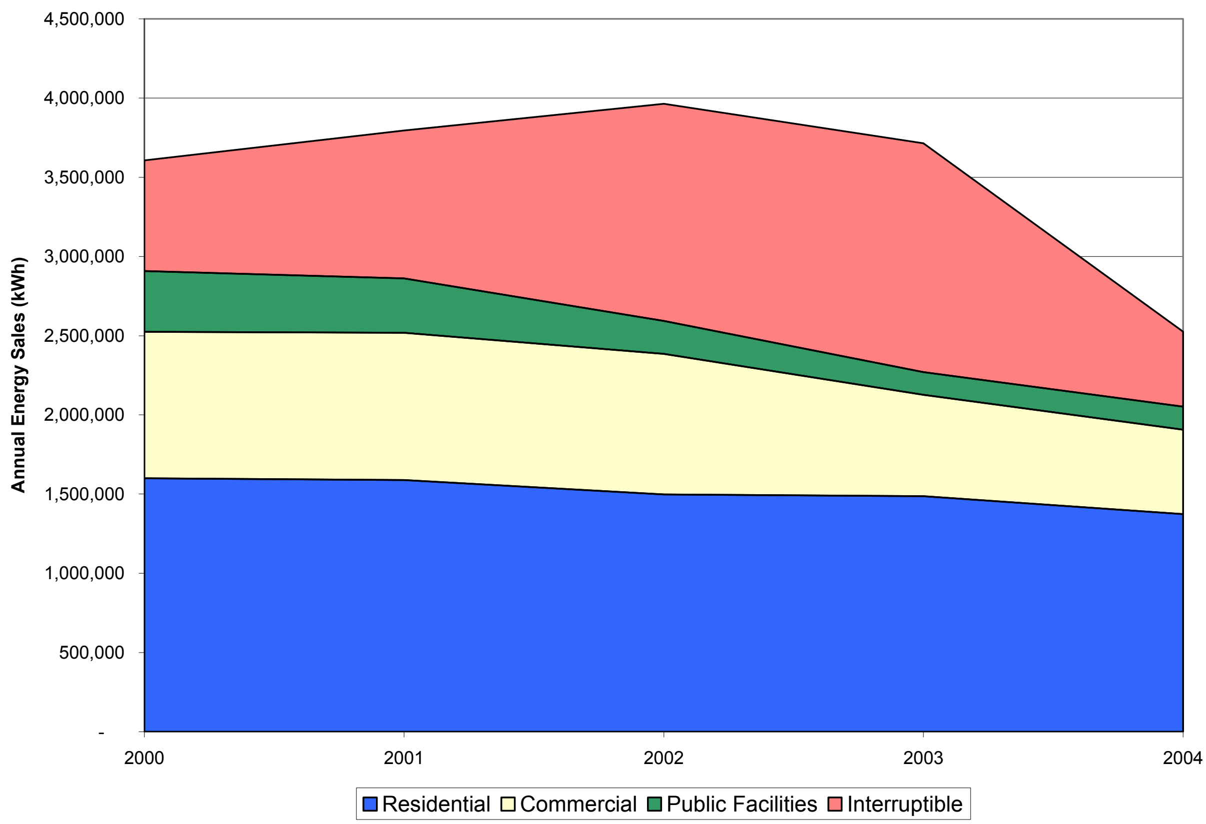
Kake

Electric service is provided to the residents and businesses of Kake by IPEC. In 2004, there were 268 residential customers, 54 commercial customers and 11 public facility customers in Kake. Average monthly energy consumption of about 425 kWh per residential customer in 2004 is significantly lower than that experienced in larger cities in Southeast Alaska. In Juneau, Ketchikan, Sitka and Petersburg average monthly energy consumption is approximately 840 kWh, 840 kWh, 920 kWh and 830 kWh, respectively[18]. The low residential energy consumption in Kake is a reflection of the high retail cost of power, which averaged 38.7 cents per kWh[19] to residential customers in 2004. Commercial rates are also in this range and undoubtedly function to significantly limit electrical consumption by commercial customers.

[18] Based on 2003 sales data for Ketchikan, Sitka and Petersburg and 2002 sales data for Juneau.
[19] The effective rate to residential customers was lowered by the State's Power Cost Equalization (PCE) program to approximately 22 cents per kWh in 2001 for the first 500 kWh purchased each month. Although the PCE program provides a significant subsidization of residential power costs, it also provides an incentive to limit power consumption to 500 kWh per month or less. It should also be noted that the funding of the PCE program is granted by the State legislature on an annual basis and no guarantees can be provided with regard to its continuation in the future.

The number of electric customers in Kake has dropped 9.0% since 2000. Although total annual energy sales remained relatively constant between 2000 and 2003, energy sales to residential and commercial customers continued to decline through this period. In 2004, the closure of Kake Foods, a seafood processing facility, contributed to an overall 32% drop in energy sales in Kake in 2004. The interruptible energy sales rate in Kake has been approximately 18.3 cents per kWh[20]. While in operation, Kake Foods had purchased a significant amount of interruptible energy from IPEC. Annual energy sales by customer class for the period 2000 through 2004 are shown in Figure 6-1.

FIGURE 6-1
Annual Energy Sales in Kake by Customer Class
(kWh)



For the purpose of this analysis, the number of residential, commercial and public facility customers served in Kake has been assumed to increase at an average annual rate of 1% per year. Energy use per account is assumed to increase at 0.5% to 1.0% per year. Some construction activities are expected in Kake during the summer of 2005, however, there has been nothing indicated at the present time that would cause a significant increase in electric energy requirements.

[20] IPEC is currently seeking an increase in the interruptible energy sales rate. The interruptible rate shown does not include the fuel cost surcharge, presently 7.57 cents per kWh.

If the KPTL and other factors[21] contribute to the lowering of IPEC's retail rates, electric consumption could increase even further. There may also be opportunities to sell additional energy to customers that may be using their own generators at the present time, however, the amount of energy that this would represent is not known.

With the KPTL, IPEC may be able to offer an economic incentive power sales rate to new commercial/industrial customers that might encourage economic development in the Kake area and increase energy sales. The economic incentive rate would be tied to the incremental cost of purchased power over the KPTL and could be significantly lower than IPEC's current interruptible rate. The impact of an economic incentive rate on Kake energy sales cannot be predicted and consequently, is not reflected in the analysis at the present time.

The projected power requirements for Kake are summarized in the following table.

TABLE 6-4
IPEC – Kake Service Area
Projected Energy Loads and Capacity Requirements

	Historical			Projected					
	2002	2003	2004	2005	2006	2007	2008	2009	2014
Energy Sales (MWh)									
Residential	1,498	1,487	1,373	1,402	1,432	1,462	1,492	1,524	1,686
Commercial	886	640	535	537	540	543	545	548	562
Interruptible [1]	1,370	1,444	474	479	484	489	494	499	524
Public Facilities	210	144	144	140	144	148	151	153	168
Other	-	-	-	-	-	-	-	-	-
Total Sales	3,964	3,714	2,526	2,558	2,599	2,641	2,682	2,724	2,941
Increase % [2]	4.4%	-6.3%	-32.0%	1.3%	1.6%	1.6%	1.6%	1.6%	1.5%
Station Service/Own Use	62	82	69	37	38	38	39	39	42
Street Lights	80	80	80	80	80	80	80	80	80
Losses	185	200	202	202	205	208	212	215	231
Total Generation (MWh)	4,291	4,076	2,877	2,877	2,922	2,967	3,013	3,058	3,294
Loss % of Gen. [3]	4.3%	4.9%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%
Peak Demand (kW)	1,016	969	684	684	695	706	717	727	783
Loadfactor [4]	48.2%	48.0%	48.0%	48.0%	48.0%	48.0%	48.0%	48.0%	48.0%

[1] Assumes interruptible sales will remain relatively constant in the future.
[2] Increase in total sales over previous year.
[3] Distribution losses and energy unaccounted for. Projected losses based on recent experience.
[4] Ratio of average demand to peak demand on an annual basis. Projected loadfactor based on recent experience.

Potential Woewodski Mining Facility

At the present time, there are no definitive plans for development of a mining facility on Woewodski Island. Olympic Resources and Bravo Ventures have indicated that they expect to continue to assess the viability of mineral reserves on Woewodski Island. If it were determined that a viable mining operation would be feasible, it is expected that several facilities would be constructed on the island to process the ore and prepare it for shipping, house equipment, offices,

[21] IPEC continues to pursue restructuring of its debt repayment which could contribute to lower retail rates.

maintenance facilities and service quarters, and provide local utility services. In addition, dock facilities, fuel storage and handling facilities and ore loading facilities will be needed.

In the past, most new mining facilities in Alaska have constructed a diesel-fueled powerplant on site. The on-site powerplants have been necessary because of the remote location of the mines, the high cost to build transmission interconnections, the general unavailability of lower cost power for purchase and the need for a highly reliable power supply that can best be provided with local generation. An example is the Kennecott Mining Company Greens Creek (KMC-GC) mine on Admiralty Island near Juneau. The KMC-GC mine was constructed with its own diesel fueled powerplant although some consideration was made during its early development to purchase power from Alaska Electric Light and Power (AELP). The on-site powerplant was deemed to be the best power supply alternative at the time, however, AELP is presently negotiating to interconnect the mine to AELP's system and sell surplus hydroelectric generation to the mine.

The proximity of Woewodski Island to the existing Tyee-Wrangell-Petersburg power system and the availability of surplus hydroelectric power from the Lake Tyee project could make the interconnection of a mining facility to the local power system a good power supply option if a mine were to be developed. As a result, the KPTL study has included two primary route alternatives that would deliver power to Woewodski Island. The economic analysis also includes the potential impact on KPTL feasibility if a mining operation were interconnected to the local regional power supply system.

For the purpose of this analysis, it has been assumed that a mining facility on Woewodski Island would have a 5,000-kW electric demand. This is in the range of but somewhat smaller than the 7,500-kW estimated electric load of the KMC-GC mine. Total annual energy requirements are assumed to be 35,000 MWh indicating an 80% loadfactor. Initial operation of a potential Woewodski mining facility has been assumed to be 2012 for this analysis. Representatives of the Woewodski mining interests have indicated that eight to ten years is a reasonable assumption of the time before a mine could become operational.

Availability of Hydroelectric Generation

Based on the foregoing projections of power requirements and the generating capabilities of the existing hydroelectric facilities, the net hydroelectric generation available for sale to Kake and a potential Woewodski mining facility can be estimated. It is important to note that hydroelectric generation capability is shown as an annual average. Actual generation can vary significantly from year to year based on local precipitation and other factors.

Lake Tyee Project

The generating capability of the 20-MW Lake Tyee project is presently committed to Petersburg and Wrangell. The Swan-Tyee transmission Intertie, currently under construction, will provide Ketchikan with access to generation from the Lake Tyee project that is surplus to the needs of Petersburg and Wrangell. Several estimates of the annual energy capability of the Lake Tyee project have been developed in the past; however, the loads connected to the project have never been large enough to evaluate how well the estimates compare with actual performance. Generally, it has been estimated that under average water conditions, the annual energy generation capability of the project is about 128,000 MWh.

Hydroelectric generation is highly variable from year to year depending on local precipitation and other environmental conditions. As previously indicated, the average annual estimated energy generation capability of the Lake Tyee project is 128,000 MWh. Under dry, low water conditions[22], the energy generation is estimated to be 112,700 MWh whereas it could be as high as 154,800 MWh.

The following table summarizes the energy generation available from the Lake Tyee project assuming average annual energy generation of 128,000 MWh from the project.

TABLE 6-5
Estimated Hydroelectric Energy Generation Available
From the Lake Tyee Project – Medium Growth, Average Water
(MWh)

	2005	2006	2007	2008	2009	2014
Lake Tyee Generation [1]	128,000	128,000	128,000	128,000	128,000	128,000
Energy Requirements [2]						
Petersburg/Wrangell	48,740	49,040	49,350	49,650	49,950	51,520
Ketchikan	-	-	20,720	21,830	22,940	28,630
Net Energy Available [3]	79,260	78,960	57,930	56,520	55,110	47,850

[1] Assumed generation for purpose of this analysis. Actual generation will vary from year to year.
[2] Based on medium growth scenario, see Tables 6-4 and 6-5. Assumes completion of Tyee-Swan Intertie in 2007.
[3] Estimated annual generation from the Lake Tyee project available to Kake.

As shown in the previous table, the net energy generation available from the Lake Tyee project in 2008 is 56,520 MWh assuming average water conditions and medium load growth in Petersburg, Wrangell and Ketchikan. This is more than enough needed to meet the energy requirement of 3,058 MWh in Kake in the same year. By 2014, available energy from Lake Tyee is 47,850 MWh and, as loads continue to increase in Petersburg, Wrangell and Ketchikan, the available energy from Lake Tyee will continue to decline. Further, in dryer than average conditions, the available energy from Lake Tyee will be less than shown in Table 6-5, potentially by as much as 16,000 MWh in any particular year. If energy generation is not available from Lake Tyee, IPEC will need to use its diesel generators in Kake to supply the necessary power requirement. As loads continue to grow in the interconnected region, however, new hydroelectric generation facilities could be constructed. The cost of power from these new facilities will potentially be higher than the cost of power from the Lake Tyee project.

[22] Alternative energy generation estimates are typically derived using the lowest and highest measured streamflow data of record at the project location.

It is also important to note that the estimated surplus energy capability of the Lake Tyee project is sufficient to supply the assumed load of the potential Woewodski mining facility of 35,000 MWh per year.

Potential New Hydroelectric Generation Facilities

A number of new hydroelectric projects have been studied that could serve the Petersburg, Wrangell, Ketchikan, and Kake areas. Costs of these projects, as well as other factors including location, generating capacity, interconnected loads and the availability of better alternatives have precluded development of these projects. The development of a transmission interconnection system could make development of some of these projects economically and technically feasible at some later date. Hydroelectric projects that have been identified, the community they are closest to, and their estimated capacity and annual energy generation, include the following:

- Lake Tyee Third Turbine[23] – Petersburg/Wrangell; 10 MW, 1,000 MWh annually
- Cascade Creek Project[24] - Petersburg; 35 MW; 165,000 estimated MWh annually
- Thomas Bay Project[25] (Ruth Lake, Scenery Lake) – Petersburg; 30 MW, 174,000 MWh
- Sunrise Lake – Wrangell; 4 MW; 12,200 MWh annually
- Anita - Kunk Lake – Wrangell; 8 MW, 28,200 MWh annually
- Virginia Lake – Wrangell; 12 MW, 42,700 MWh annually
- Thoms Lake – Wrangell; 7.3 MW, 25,600 MWh annually
- Whitman Lake – Ketchikan; 4.6 MW, 19,600 MWh annually
- Connell Lake – Ketchikan; 1.9 MW, 11,640 MWh
- Lake Grace[26] – Ketchikan; diversion to Swan Lake project, 72,200 MWh annually
- Mahoney Lake – Ketchikan; 9.6 MW, 45,600 MWh annually
- Triangle Lake[27] – Metlakatla; 3.9 MW, 16,900 MWh annually

Of the projects indicated in the preceding list, several are farther along in the development process than others. The City of Ketchikan is presently working to license the Whitman Lake project so that it can be designed and constructed. In the past five years, the Cape Fox Corporation has undertaken licensing and design activities with regard to the Mahoney Lake but has been unable to secure necessary power sales agreements to support further development of the project at the present time. Tollhouse Energy is pursuing development of the 35-MW

[23] A third turbine at the Lake Tyee project would not provide much additional annual energy generation. Rather, this turbine would allow for greater operational flexibility and greater capacity output at certain times.
[24] The Cascade Creek project, as proposed by Tollhouse Energy, is one component of the larger Thomas Bay hydroelectric project identified by Hosey & Associates in a study for the City of Petersburg dated December 1985. The Cascade Creek project is the Swan Lake portion of the overall Thomas Bay potential development.
[25] As proposed in the Hosey & Associates study, water from Scenery Lake and Ruth Lake could be diverted to the Swan Lake (Cascade Creek) portion of the overall Thomas Bay project development for additional power output.
[26] The Lake Grace is located within the Misty Fjords National Monument and would require an act of congress if a hydroelectric project were to be developed.
[27] A relatively short overhead and submarine transmission system would be needed to interconnect the electric systems of Ketchikan and Metlakatla Power & Light.

Cascade Creek project and has indicated an interest in marketing the power output of the project to Canadian interests. This would require development of significant new transmission lines interconnecting the TWP system to BC Hydro.

In addition to the projects listed above, Coast Mountain Hydro Corporation, a Canadian company, has proposed to develop the 115-MW Forrest Kerr hydroelectric project at the confluence of Forrest Kerr Creek and the Iskut River approximately 25 miles northeast of the Alaska-Canada border. The project will be run-of-river and the power output is to be sold to BC Hydro. At the present time, the BC Hydro transmission system only extends as far north as Meziadin Junction. A 110-mile long 138-kV transmission line is proposed to be constructed from Meziadin Junction to the Forrest Kerr Project. Several mines in the general vicinity of the Forrest Kerr Project are looking to purchase power from BC Hydro so the new transmission line will have multiple uses. Coast Mountain Hydro indicates that it has the necessary permits for the project and is presently in the process of final design. Several contracts are in place to supply the turbines and pipeline and provide certain major civil works although funding for the project has not been fully arranged yet. See the map in Appendix B for a general location of the BC Hydro transmission system, the Forrest Kerr project and the Alaska power system.

Use of Oil-Fired Generating Facilities

Although it has been indicated that only hydroelectric generation would be transmitted over the KPTL, power generated at diesel power plants in Petersburg or Wrangell could be transmitted just as well. The use of diesel generators from outside Kake, however, would need to acknowledge the additional cost associated with transmission losses as well as the cost differential between surplus hydroelectric power and diesel generation. In some cases, it could be less costly to purchase out-of-area diesel generation than run local generators. This will need to be factored in to the contracts for power supply services.

Economic Analysis of Interties

Introduction and Assumptions

An economic analysis has been conducted to determine if the benefits to be realized with the KPTL are greater than the costs of operating the KPTL and purchasing power from hydroelectric resources. Benefits will be achieved through the offset of diesel generation costs at Kake. Costs related to the KPTL are direct costs of operations and maintenance (O&M), certain incremental administrative and general (A&G) costs of KWETICO, renewals and replacements (R&R) and the costs of purchasing power from the Four Dam Pool to serve Kake loads.

The economic analysis has also been extended to evaluate the costs and benefits associated with serving loads at a potential mining facility on Woewodski Island. For the Woewodski mine, the costs of purchased power, and KPTL O&M and administrative costs are compared to the cost of local diesel generation on Woewodski Island.

In preparing this analysis, several assumptions have been made. The most significant of these assumptions are:

- Capital costs of the KPTL are to be grant funded meaning that there will be no capital recovery component associated with the KPTL. This assumption applies to the KPTL itself as well as the tap-line to be built to supply the Woewodski mine.
- Base year (2005) delivered fuel prices are $1.80 per gallon in Kake decreasing by 10% in 2006 and increasing by 3% per year thereafter[28]. Since fuel prices are highly variable and subject to radical changes, the impacts of alternative fuel price assumptions have been considered in a sensitivity analysis.
- O&M and A&G costs will escalate at the assumed annual inflation rate of 2.5% per year.
- Existing generation capacity will be maintained for emergency backup in Kake and at the Woewodski mining facility. Resulting net O&M costs will be significantly lower than if the generating units were operated to supply full load.
- KWETICO, the owner of the KPTL will contract with others to provide maintenance on the KPTL systems. Administrative costs associated with ownership and operation of the KPTL will be minimal.
- A reserve fund will be established to collect monies for major maintenance and repairs in the future. The reserve fund will also serve as a self-insurance fund since transmission lines are generally not insurable.
- The cost of purchased power from the Four Dam Pool Power Agency will be inclusive of all transmission and delivery charges to the point of delivery, expected to be at the new switchyard interconnection point near Petersburg.
- Energy losses over the KPTL will be 2% of the transmitted power to Kake and the Woewodski mining facility, based on engineering estimates.

The economic analysis estimates the power production costs for Kake and the Woewodski mine that will be offset if the KPTL is constructed. These "benefits" are then compared to the costs of power purchases and KPTL operation to determine if the benefits of the KPTL exceed the costs. To be economically feasible, the Southeast Conference has indicated that the KPTL will need to show positive benefits on its own, i.e. the costs of the KPTL will be borne entirely by the users of the line and not melded in with other KWETICO transmission lines. To protect the interests of electric consumers, the total costs incurred by IPEC must be lower with the KPTL than without to show economic justification for the KPTL.

It should be noted that costs of operation that are the same with or without the KPTL are not included in the analysis. Examples of these costs are capital recovery on existing generation plant and fixed O&M charges.

[28] IPEC's actual cost of generation fuel for its Kake operation averaged approximately $1.49 per gallon in 2004. The price of fuel has increased substantially in early 2005, averaging $1.92 per gallon in the first quarter and was as high as $2.22 per gallon in April before dropping to $1.99 per gallon in June 2005.

Projected Cost of Existing Diesel Generation

IPEC owns and operates diesel generators in Kake to supply the full power supply requirement of the local community. Total installed generation capacity is 2,585 kW in Kake supplied with three generating units. The primary cost in operating the diesel generators is the cost of fuel, which represented well over half the total power production costs in IPEC's system over the past three years.

Without the need to operate their diesel generators except in emergency situations, IPEC should be able to reduce the O&M costs associated with the diesel generating units. The need for maintenance activities, lubricants and other consumables will be substantially reduced and maintenance and operating personnel can be assigned to other activities. Based on a review of IPEC's production costs, it is estimated that the variable O&M cost[29] is about 3.0 cents per kWh.

For the purpose of evaluating the potential costs and benefits associated with a mining operation on Woewodski Island, it is assumed that a diesel-fueled power plant would be installed and used to provide the full power requirement of the mine if the KPTL is not constructed. The variable O&M cost for this powerplant is assumed to be about 1.5 cents per kWh, comparable to the O&M cost for the existing powerplant at the KMC-GC mine. KMC-GC presently has a staff of four to operate its powerplant and also pays a monthly fee for a maintenance contract on the oil-fired combustion turbine installed at the mine powerplant.

In addition to the offset of fuel and O&M costs, IPEC will benefit from the extension in operating life of its existing generators in Kake if the KPTL is constructed. Without the KPTL, continued regular operation of the existing generators would require their eventual replacement or major overhaul. For the purpose of this analysis, it has been assumed that without the KPTL, IPEC will install a 1,000-kW replacement generator in 2015 and another 1,000-kW replacement generator in 2020 at a present day cost of $400,000 per unit. With the KPTL, the cost of these new generators would be avoided.

The cost of generation fuel is a critical factor in the cost of power production for IPEC. Fuel prices in Kake in April 2005 were reported at $2.22 per gallon, significantly higher than the average fuel price of $1.49 per gallon incurred in 2004. Fuel prices in IPEC's Hoonah service area typically average 20-30 cents more per gallon than in Kake[30]. It is not expected that diesel fuel prices will stay at the current high level, however, it is not expected that they will decrease to price levels experienced before 2004. Consequently, for the purpose of this analysis, the price of diesel fuel has been assumed to be $1.80 per gallon in Kake in 2005, reduced by 10% in 2006 and increased by 3.0% per year thereafter. This long-term increase assumption allows for the increase in fuel prices at a rate of 0.5% per year over the assumed rate of general inflation of 2.5% per year.

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[29] Power production costs are often characterized as variable, those costs that are directly associated with each unit of operation, and fixed, costs that are not avoidable. The costs of operations personnel are considered fixed for IPEC's Kake service area.

[30] IPEC operates fuel storage tanks in Kake that allow for barge deliveries of fuel in large enough quantities to obtain somewhat lower prices when compared to other locations where truck delivery is needed.

The following tables show the projected variable cost of power production over the next ten years at Kake, based on continued use of oil-fired generation. It is important to note that the variable cost of production is not the full cost of power production, but rather is the cost that could be directly avoided if the KPTL were constructed.

TABLE 6-6
Projected Variable Cost of Power Production with Diesel Generation
IPEC – Kake Service Area

	2005	2006	2007	2008	2009	2014
Energy Requirements (MWh) [1]	2,877	2,922	2,967	3,013	3,058	3,294
Fuel Price ($/gallon) [2]	$ 1.80	$ 1.62	$ 1.67	$ 1.72	$ 1.77	$ 2.05
Power Production Cost ($000)						
Fuel Cost [3]	$ 378	$ 346	$ 361	$ 378	$ 395	$ 493
Variable O&M [4]	86	90	94	97	101	123
Subtotal	$ 464	$ 436	$ 455	$ 475	$ 496	$ 616
Replacement Cost [5]	-	-	-	-	-	-
Total Production Cost	$ 464	$ 436	$ 455	$ 475	$ 496	$ 616
(¢/kWh)	16.1	14.9	15.3	15.8	16.2	18.7

1 See Table 6-4.

2 Assumes decrease in fuel prices of 10% in 2006 and annual increases of 3% thereafter.

3 Based on average fuel usage of 13.7 kWh per gallon.

4 Estimated variable O&M cost of 3.0 cents per kWh based on IPEC identified production cost items of miscellaneous power generation expenses, generator overhaul and maintenance expenses, maintenance supervision and maintenance salaries and miscellaneous. Does not include generation salaries and costs associated with maintenance of structures. Assumed to increase annually at the assumed rate of general inflation.

5 No replacement of generation plant is expected in Kake until after 2014.

As previously indicated, it is not known at the present time if or when a mining facility will be developed on Woewodski Island. The following table provides an estimated cost of power production based on diesel generation assuming a mine becomes operational in 2012.

TABLE 6-7
Projected Variable Cost of Power Production with Oil-Fired Generation
Assumed Woewodski Island Mining Facility

	2012	2013	2014	2015	2016	2021
Energy Requirements (MWh) [1]	35,040	35,040	35,040	35,040	35,040	35,040
Fuel Price ($/gallon) [2]	$ 1.93	$ 1.99	$ 2.05	$ 2.11	$ 2.18	$ 2.52
Power Production Cost ($000)						
Fuel Cost [3]	$ 5,021	$ 5,171	$ 5,327	$ 5,486	$ 5,651	$ 6,551
Variable O&M [4]	625	640	656	673	690	780
Subtotal	$ 5,646	$ 5,811	$ 5,983	$ 6,159	$ 6,341	$ 7,331
Replacement Cost [5]	-	-	-	-	-	-
Total Production Cost	$ 5,646	$ 5,811	$ 5,983	$ 6,159	$ 6,341	$ 7,331
(¢/kWh)	16.1	16.6	17.1	17.6	18.1	20.9

1 Assumed to be a 5-MW load at an 80% annual loadfactor.

[2] Assumes fuel prices to be the same as in Kake.
[3] Based on average fuel usage of 13.5 kWh per gallon.
[4] Estimated variable O&M cost of 1.5 cents per kWh, increased annually at the assumed rate of general inflation.
[5] No replacement of generators will be needed during this period.

KPTL Annual Costs

A number of regular maintenance activities will be needed to inspect the KPTL condition and make necessary repairs. Generally, these activities will be relatively minor, particularly in the early years of KPTL operation. Structures, guys, insulators, conductors and submarine cable terminations will need to be inspected visually and a program to regularly clear trees and brush from the right of way will need to be established. It is expected that KWETICO, as owner of the KPTL, will contract out the regular inspection and maintenance activities to local utilities or other providers of this kind of service.

The final design of the KPTL is expected to include relatively short “ruling spans” which should reduce maintenance costs and the likelihood of damage due to various environmental factors. Further, a significant portion of the KPTL is expected to be located adjacent to USFS roads which will make access much easier and keep maintenance costs lower than would be experienced if the KPTL were located in remote locations. Much of the route of the KPTL will include a full service access road to provide regular access for maintenance.

All of the planned, regular maintenance activities for the KPTL will be scheduled during the summer months when access to the line is not restricted by weather conditions. Periodically, access to the KPTL will be needed in the winter to make repairs to the line necessitated by damage caused by falling trees or other factors. If the KPTL were located adjacent to roads maintained all year, winter time access will be relatively straightforward. Indications from local residents would indicate, however, that snow cover in the general vicinity of the proposed KPTL routes will not generally be a significant deterrent to winter access, even on the KPTL access road which is not expected to be plowed in the winter. Consequently, the annual cost of maintenance for the KPTL is not expected to be noticeably different for the KPTL located adjacent to year around maintained roads or along the planned maintenance road.

Depending on the availability of maintenance equipment in Kake, it may be necessary to purchase certain maintenance vehicles and equipment for workers to use when maintenance is needed. Included in this equipment inventory would be two all-terrain vehicles, two trailers, two flatbed trucks, and two maintenance buildings. The estimated cost of this equipment is $975,000 and one set would be stationed on the Lindenberg Peninsula while the other is stationed in Kake. Arrangements with IPEC may make it possible for KWETICO to rent necessary equipment from IPEC as available.

The estimated costs of maintaining the KPTL are expected to increase somewhat over time as clearing requirements increase and the system gets older. The estimated costs of O&M for the KPTL are provided in Table 6-8. Basic assumptions used in the development of the O&M estimate include the following:

- The existing Forest Service roads will be maintained by the USFS. The additional roads that are added in the respective KPTL route estimate(s) will be maintained by KWETICO and are reflected in the KPTL O&M cost estimate.
- The O&M estimates provided in Table 6-8 represent the routes estimated and studied in the "Center" corridor of the study area. The O&M costs do not reflect the heavily forested areas of either the Southern or Northern routes.
- The values represented for "Tree Trimming" are the costs to remove and manage the danger trees that are expected to be an issue in the early years. In the later years management of growth in the vicinity of the KPTL will be the focus.
- IPEC has standby generation in Kake which should be maintained to support scheduled and unscheduled circuit outages. The standby generation will also minimize the need for costly outage restoration in bad weather or emergency response and increase reliability.
- The road network will permit access to most of the structures year around. Special maintenance equipment (track vehicle with trailer) with covered storage has been budgeted for the areas identified on the KPTL route map identified as Nodes T2 and K.
- The proposed design of the KPTL has focused on minimizing O&M costs by providing maintenance personnel the use of a road network that will allow access to the KPTL. The KPTL has been located adjacent or close to the road network to facilitate ease of construction and access for O&M.
- Should the Sitka Transmission "Tie Line" be completed to Kake the maintenance and reliability of the O&M budget should be re-evaluated.

TABLE 6-8

Kake – Petersburg Transmission Line
Estimated Annual O&M Costs

	Years 1-5	Years 6-10	Years 11-15	Years 16-20
Maintenance of Equipment	$ 30,000	$ 35,000	$ 45,000	$ 60,000
Tree Trimming	55,000	60,000	70,000	80,000
Overhead Line Inspections	10,000	15,000	20,000	25,000
Regular Repairs/Replacements	25,000	35,000	45,000	45,000
Submarine Terminal Inspections	5,000	10,000	10,000	10,000
Switchyard Maintenance	10,000	10,000	10,000	10,000
Miscellaneous	20,000	20,000	20,000	20,000
Total	$ 155,000	$ 185,000	$ 220,000	$ 250,000
Unit Cost (¢/kWh) [1]	5.0	6.0	7.1	8.1

[1] Unit cost of O&M assuming energy sales of 3,100 MWh to Kake.

If the Woewodski Tap is built, the additional annual O&M cost is estimated to be approximately $50,000. If the mining facility is developed and the Woewodski Tap is built these additional costs will be borne by the mining facility. In addition, the mining facility would be expected to pay a pro rata share (based on annual energy sales) of the annual KPTL O&M expense since the KPTL will be an integral component in delivering power to the Woewodski mine.

KWETICO, will incur certain expenses related to policy oversight, accounting, general administration and management. These costs would be expected to be paid by all users of the KWETICO transmission system. The following table provides the estimated administrative costs of KWETICO for the KPTL based on the current budget for KWETICO associated with the Juneau-Greens Creek transmission line.

TABLE 6-9
Estimated Annual KPTL Administrative Costs [1]

Annual USFS Road Easement Fee	$	10,000
Submarine Cable Easement Fee		10,000
Directors and Officers Liability Insurance [2]		4,500
General Liability Insurance [2]		5,000
Accounting and Audit Expenses [2]		5,000
Legal Fees [2]		5,000
Miscellaneous		3,000
Contingencies		3,000
Total	$	45,500
Unit Cost (¢/kWh) [3]		1.47

[1] Based on KWETICO currently projected costs.
[2] Assumes cost sharing with Juneau-Greens Creek transmission line.
[3] Unit cost assuming 3,100 MWh sales to Kake.

O&M and administrative costs are expected to be recovered through charges to IPEC and the Woewodski mine that are directly proportional to the power transmitted. The charges could be included as part of the wholesale cost of power. In addition to O&M and administrative costs, a charge related to the accrual of reserve funds to pay for major repairs to the KPTL should be included in the costs charged to IPEC and the Woewodski mine. These costs are not expected to be significant in the early years of KPTL operation and are in lieu of a depreciation charge. The reserve fund charge is also a means for "self-insuring" the KPTL since transmission lines are generally not insurable.

As a basis for the amount of this repair and replacement (R&R) reserve that should be established, the estimated cost of a major repair or replacement of a significant system component can be used. It can also be reasonably assumed that with a new system, the timing of such a major repair or replacement would be several years in the future. For the KPTL, a reserve requirement of $1.0 million has been estimated based on the cost of a major submarine cable repair. Annual deposits of $46,000 for the KPTL would be needed to build up the reserve fund balance to these amounts within 15 years with accrued interest at 5% per year.

Cost of Purchased Power

With the KPTL, power is expected to be purchased from the Four Dam Pool Power Agency (FDPPA) by IPEC for use in Kake. At the present time, the FDPPA firm power sales rate to the members of the Four Dam Pool is 6.8 cents per kWh. This rate could increase somewhat in the future but is expected to remain relatively constant for the next few years. Discussions with FDPPA management indicate that power could possibly be sold to IPEC at a rate that is comparable to the existing firm power sales rate. A major consideration, however, are the tax implications to the FDPPA if power is sold to entities that are not municipally-owned utilities[31]. If sales of power to IPEC were to negatively affect the interest rate benefits presently realized by the FDPPA, the power sales rate to IPEC would potentially need to be higher than the current firm power sales rate.

There is some possibility that IPEC could be sold power at an interruptible power sales rate because of the possibility of interruption in availability[32]. The Four Dam Pool has sold power to certain customers on an interruptible basis in the past at lower rates than the firm power sales rate. For purposes of this study, it has been assumed that power can be purchased from the Four Dam Pool by IPEC at 6.8 cents per kWh through 2029. This cost would include delivery charges to Petersburg[33].

Although power should be available from the Lake Tyee Project to sell to a potential mining facility on Woewodski Island, the power sales rate is uncertain. The rate would most likely need to be higher than the 6.8 cents per kWh firm power sales rate charged to the FDPPA members. The rate cannot be predicted at this time, however, so 6.8 cents per kWh has been assumed for purpose of this analysis.

Estimated Savings with the KPTL

Based on the foregoing, the cost of power to IPEC and the Woewodski mining facility with the KPTL has been projected. This cost includes the cost of purchased power and the costs of KPTL O&M and administration allocated to each line. The costs with the KPTL have then been compared to the costs without the KPTL to determine the net savings to IPEC and the Woewodski mine associated with the KPTL. The cost of power with the KPTL and the estimated savings in each load center are shown on an annual basis in the following tables assuming that the KPTL is constructed and begins operation in 2009. An additional case has been run assuming that the Woewodski mine begins operation in 2012. Until the Woewodski mine begins operation, IPEC will need to cover the full operating cost of the KPTL.

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[31] In 2004, the FDPPA issued tax-exempt revenue bonds in an amount consistent with the projected percentage of its total energy sales to Wrangell, Petersburg and Ketchikan, all municipal utilities. Since a portion of the FDPPA energy sales is to cooperative utilities, taxable bonds were also issued at the same time. If the ratio of FDPPA energy sales to taxable and tax-exempt agencies changes, the FDPPA may be restricted as to what type of entity it sells power to. A legal analysis will be needed to fully define this issue.

[32] As indicated previously and shown in Table 3-8, it is expected that the full power requirement of Kake can regularly be supplied from the Lake Tyee project for several years to come, but cannot be fully guaranteed.

[33] Energy losses from Lake Tyee to the KPTL tap point near Petersburg are also expected to be effectively included in the power sales rate. Since the metering point for power sales to Kake is to be at the tap point, energy losses between the tap point and Kake will need to be included as a cost to IPEC.

TABLE 6-10
Projected Cost of Power and Savings with the KPTL
IPEC – Kake Service Area
(Without Woewodski Mine)

	2009	2010	2011	2012	2013	2018
Energy Requirements (MWh) [1]	3,058	3,104	3,151	3,198	3,246	3,496
Energy Purchased (MWh) [2]	3,119	3,166	3,214	3,262	3,311	3,566
Purchased Power Price (¢/kWh) [3]	6.8	6.8	6.8	6.8	6.8	6.8
Annual Costs with KPTL ($000)						
Purchased Power [4]	$ 208	$ 211	$ 214	$ 217	$ 221	$ 238
KPTL O&M [5]	171	175	180	184	189	255
KPTL A&G [6]	50	51	53	54	55	63
KPTL R&R [7]	46	46	46	46	46	46
Total Annual Costs with KPTL	$ 475	$ 483	$ 493	$ 501	$ 511	$ 602
Unit Cost (¢/kWh) [8]	15.5	15.6	15.6	15.7	15.7	17.2
Savings with KPTL ($000) [9]	$ 21	$ 35	$ 49	$ 65	$ 80	$ 167
Savings (¢/kWh) [10]	0.7	1.1	1.6	2.0	2.5	4.8
Breakeven Cost of Power (¢/kWh) [11]	7.3	7.8	8.2	8.6	9.1	11.4
NPV Savings (2009-2028) ($000)	$ 1,257					
Discount Rate	6.0%					

1 See Table 6-4.
2 Includes estimated transmission losses of 2% between Petersburg and Kake.
3 Estimated price of power purchased from the Four Dam Pool Power Agency.
4 Estimated cost of power purchased from the Four Dam Pool Power Agency.
5 KPTL O&M cost as shown in Table 6-8 fully allocated to IPEC. Assumes O&M costs increase annually at the assumed rate of general inflation.
6 KPTL A&G cost as shown in Table 6-9 fully allocated to IPEC. Assumes A&G costs increase annually at the assumed rate of general inflation.
7 Annual deposit to KPTL R&R fund to establish a $1.0 million balance in 15 years with accrued interest at an assumed 5% interest rate. Cost is fully allocated to IPEC.
8 Total Annual Costs divided by Total Energy Requirement.
9 Total Production Cost for the diesel generation case (see Table 6-6) less Total Annual Costs with KPTL.
10 Savings with KPTL divided by Total Energy Requirements.
11 Estimated price for purchased power over the KPTL that could be paid and produce no annual savings.

As shown in Table 6-10, the estimated savings to IPEC in 2009, the first year of KPTL operation is $21,000. Table 6-10 also shows that the average charge for electric service in Kake could potentially be reduced by 0.7 cents per kWh with the KPTL[34]. Annual savings with the KPTL are expected to increase each year primarily due to assumed increases in the cost of diesel fuel that the KPTL will offset. In 2018, the projected savings are 4.8 cents per kWh. Over the first twenty years of KPTL operation, 2009-2028, the net present value of savings to IPEC with the KPTL is $1,257,000, assuming a 6% discount rate[35].

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[34] Due to the effects of the State Power Cost Equalization program, any savings in IPEC's cost of power due to the KPTL would not necessarily show up in reductions in the effective charges for residential electric service. Rather, the amount of subsidy from PCE provided to IPEC would be reduced.
[35] The discount rate for IPEC is based on IPEC's cost of capital, which is generally a relatively low interest rate of 5% - 6%.

If a mining facility were developed on Woewodski Island and power sales to the mine began in 2012, the costs of operating and maintaining the KPTL could be shared between IPEC and the mine. With a mining operation, the net present value savings to IPEC with the KPTL over the period 2009-2028 would be $3,778,000. The net present value savings to the Woewodski mine with the KPTL would be $21,195,000 over the 17 year period, 2012 through 2028, assuming an 8% discount rate. This is nearly double the estimated cost to construct the Woewodski Tap, meaning that the mine could pay to construct the Woewodski Tap and would still realize significant benefits it could purchase power from the FDPPA at 6.8 cents per kWh.

A significant benefit to IPEC with the KPTL will be the ability to establish economic incentive rates for new large commercial/industrial electric consumers. As long as regular retail energy sales remain relatively stable in Kake, the fixed costs of IPEC's distribution system and the KPTL will be recovered through normal rates. Consequently, an economic incentive rate based on the incremental cost of purchased power (6.8 cents per kWh in the above table) plus a nominal margin could be established[36]. This rate would need to be negotiated on a case by case basis and should have a time limit to it (e.g. 5-10 years), but could be used to attract new commercial activity to the Kake area.

Economic incentive rates have been used in recent years by Sitka and other utilities. Sitka has surplus hydroelectric generation capability and has recently implemented an interruptible energy sales rate to commercial customers to encourage greater electricity sales. The interruptible energy sales rate is less than the normal commercial energy rate.

The savings estimated for IPEC's Kake service areas could, but would not necessarily be transferred directly through to a reduction in rates for electric service in Kake. IPEC presently charges the same rates for all of its service areas[37] based on the combined costs of the entire system. The estimation of IPEC's power rates is beyond the scope of this study. The State's Power Cost Equalization program would also affect how much of the Intertie provided savings would be realized by residential consumers in Kake[38]. The PCE program is funded each year by the State legislature and its funding magnitude as well as its continuation is uncertain.

Sensitivity of Results to Alternative Assumptions

As previously indicated, a number of assumptions have been made in preparing the comparative economic analysis used to determine the benefits of the KPTL. Principal among the variables with significant impact on the results are load growth in Kake, future diesel fuel prices and future inflation. Alternative assumptions for these variables could potentially produce significantly different results. For each of the alternative cases in Table 6-11, it is important to note that only

[36] The Four Dam Pool Power Agency would also need to be involved in any discussions of additional energy purchases for economic incentive purposes if a special interruptible energy purchase rate were to be pursued.
[37] IPEC has indicated that it may need to establish rates in each service area based on the cost of service in the respective areas, at the request of the Regulatory Commission of Alaska (RCA).
[38] Essentially, the PCE program provides a subsidy to residential electric consumers. The amount of the subsidy is based on the local cost of power production. According to the program formula, if the cost of power production decreases, as it does when fuel prices drop, the magnitude of the subsidy would also decrease. The amount of the subsidy is also a function of the legislatively approved contribution to the program each year.

the specifically identified assumption is changed. All other assumptions remain the same as provided in the base case. Detailed annual costs for each scenario are provided in Appendix F.

TABLE 6-11
Comparison of Savings with the KPTL using Alternative Assumptions
IPEC – Kake Service Area
(Without Woewodski Mine)

	Annual Cost of Power (¢/kWh) [1]				
	2009		2014		
	Without KPTL	With KPTL	Without KPTL	With KPTL	30-Year NPV Savings with KPTL [2]
Base Case [3]	16.2	15.5	18.7	16.9	$ 1,257,000
High Fuel Price [4]	20.4	15.5	24.5	16.9	$ 3,565,000
High Kake Loads [5]	16.2	12.9	18.7	13.6	$ 3,683,000
No Load Growth [6]	16.2	16.2	18.7	18.6	$ 420,000

[1] Estimated annual cost of power production based on the cost of fuel and diesel generator O&M for the "Without KPTL" scenarios and based on the cost of purchased power and KPTL O&M for the "With KPTL" scenarios.
[2] Estimated cumulative present value savings of KPTL benefits between 2009 and 2028 to January 2005. Assumes discount rate of 6%.
[3] Based on assumptions used in Tables 6-6 and 6-10.
[4] Assumes 2005 fuel cost of $2.00 escalated at 4.0% per year thereafter.
[5] Assumes large commercial and interruptible energy loads will increase in 2009 to the approximate level experienced in 2002. After 2009, energy consumption for all customer classes is assumed to increase 2% per year. Note that the fuel costs assumed in this case are the same as used in the Base Case.
[6] Assumes energy loads in Kake remain the same as experienced in 2004 throughout the projection period.

Other Factors

Integration With Southeast Alaska Intertie System

The KPTL is an important part of the previously defined Southeast Alaska Intertie System. Initially, the KPTL will serve as a component of the southern Southeast Alaska Intertie System that will interconnect the communities of Ketchikan, Petersburg, Wrangell, Kake and Metlakatla. The KPTL will offer the potential of providing transmission service to mining loads on Woewodksi Island. Eventually, the KPTL will serve as a vital link in the transmission interconnection to Sitka and eventually to Juneau. The connection to Sitka could offer additional hydroelectric resources to the southern Southeast Alaska communities.

The Southern Woewodski Route Alternative of the KPTL provides the additional benefit of a potential interconnection to Prince of Wales Island and Alaska Power Company's electric system. With the Southern Woewodski Alternative, the KPTL would be located on the southern end of Kupreanof Island. A submarine cable to Prince of Wales Island from this location could potentially be preferred to the previously proposed submarine cable between Ketchikan and Prince of Wales Island. The Woewodski Tap Alternative could also be used as a potential connection point to Prince of Wales Island.

Integration with BC Hydro System

BC Hydro owns and operates a very large electric power system in British Columbia, Canada. BC Hydro's 138-kV transmission system in the vicinity of Southeast Alaska presently extends only as far north as Meziadin Junction just northeast of Stewart, B.C. A 110-mile long 138-kV transmission line is proposed to be constructed from Meziadin Junction to the Forrest Kerr Hydroelectric Project located approximately 25 miles from the Alaska border on the Iskut River. Several mines in the general vicinity of the Forrest Kerr Project are looking to purchase power from BC Hydro so the new transmission line will have multiple uses.

It has also been speculated that BC Hydro may be considering the possibility of extending its transmission system as far north as Dease Lake about 130 miles north of the Forrest Kerr Project. Dease Lake is relatively close to the Stikine River.

Tollhouse Energy, the prospective developers of the Cascade Creek Hydroelectric Project near Petersburg, has proposed the concept of constructing a transmission line up the Bradfield Canal to interconnect with BC Hydro's system at the Forrest Kerr Project. The purpose of this line from Tollhouse's perspective would be to provide Southeast Alaska with access to other power markets. Tollhouse indicates that it could provide power to BC Hydro from the Cascade Creek Project to meet obligations of the Bonneville Power Administration (Bonneville) to supply a certain amount of power to Canada pursuant to an international exchange agreement. This exchange agreement requires Bonneville to supply power to BC Hydro in compensation for the additional generation realized by the hydroelectric generators on the Columbia River resulting from upstream water storage projects located in Canada. Tollhouse Energy has indicated that it has had preliminary discussion with Bonneville and BC Hydro on this matter.

At the present time, there are no plans to develop a transmission line to interconnect BC Hydro and Southeast Alaska. BC Hydro has conducted technical studies and prepared cost and schedule estimates related to its options in extending its existing transmission system north on the Canadian side of the border.